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Southern Pacific Repairs

By Howard Campbell
Western Editor, *American Machinist*

Saving time and work by use of air cylinders—Ball-bearing roller tools — Friction chuck for taps and reamers — Turning lift shafts — Other good tools

EFFICIENCY in a railway repair shop—as in any other shop—depends very largely on having the right machine for the job. The equipment of the Southern Pacific Lines at Houston, Texas, includes not only a fine selection of modern machines of the standard type, but also a number of labor-saving devices that have been designed and built in the shop toolroom. Special attention has been paid to the elimination of hand labor, and it has been found that the mechanical appliance that saves man-power also invariably produces better work and in less time. Some of the tools and methods are described herewith and information is given as to the machine equipment.

The operation of shaping the ends of a pair of cast-steel link blocks is shown in Fig. 1. The machine is a 60-in. Morton traveling head draw-cut shaper and the toolholder is carrying a 1¼x2-in. high-speed steel tool. Two pieces are machined at a setting and are clamped to the table of the machine in tandem, as shown. In this particular operation the ram is set for a 28-in. stroke and operates at the rate of six strokes per minute, removing ¼ in. on the roughing cut and ⅛ in. on the finishing cut, using a feed of 1/16 in. per stroke. Both castings can be machined in approximately five hours.

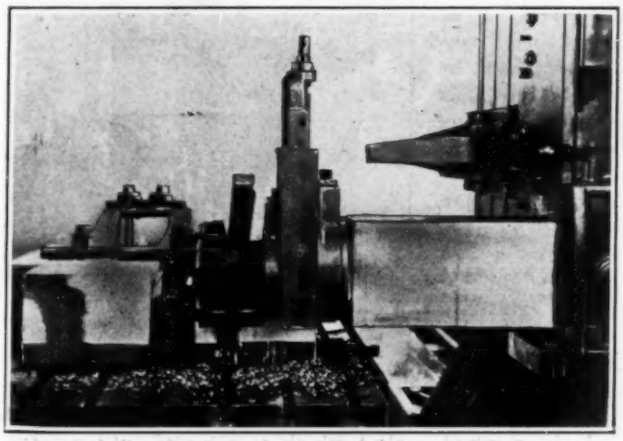


Fig. 1—Shaping ends of link blocks

In Fig. 2 the same machine is shown boring and facing a 20x28-in. cylinder. The tools are revolving at a speed of 4.6 r.p.m., or 24 ft. per min., and are removing ½ in. of stock with a feed of 3/32 in. per revolution. Two tools are used on the roughing operation, one in each side of the boring head. On the finishing cut only one tool is used, which removes about 0.015 in. of metal with a ½-in. feed. The boring and facing of the cylinder and valve chamber is done in approximately 13 hours.

Locomotives on the Southern Pacific Lines are remarkably free from leaks in cylinder head and steam

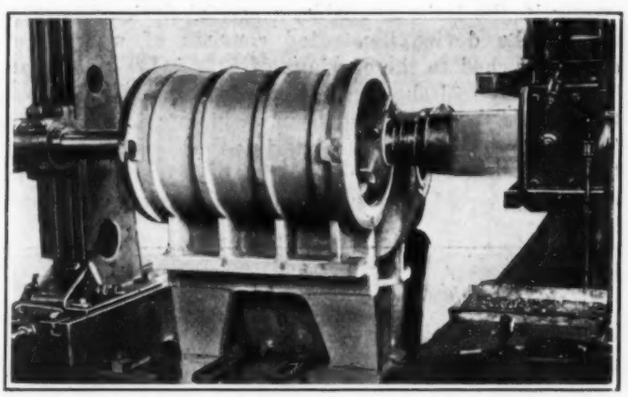


Fig. 2—Boring cylinder

chest joints, because all joints are ground in. The apparatus used for performing the grinding operation is illustrated in Fig. 3. The grinding compound is applied to the joint and the head is slipped into place on the cylinder, where it is held by an adjustable bar braced against the pilot beam. The desired pressure against the cylinder head is obtained by the use of a spring adjusted by means of a nut and a section of pipe that slips over one end of the bar. Reciprocating motion of the cylinder head is obtained by the use of the steam end of a 9½-in. air pump, which is coupled to the cylinder head through the medium of a hardwood lever. The pump is coupled to the shop air-line. A steam-tight joint is usually obtained in from 30 to 45 min.

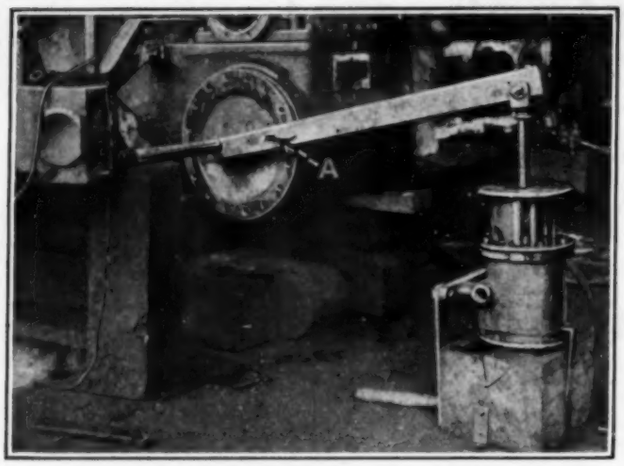


Fig. 3—Grinding-in cylinder head

Occasionally, however, where the joint is corroded to some extent, from 1½ to 2 hrs. are required.

The piston valve chamber, as shown in Fig. 4, is ground in to the valve face of the cylinder. The motive power is applied by a close-quarter motor, attached to a vertical shaft that carries an eccentric on the upper end. The shaft runs in bearings bolted to the front of the cylinder. A rod extends from the eccentric to the back end of the valve chamber, to which it is fastened by means of a strap. A tight joint is obtained in approximately three hours.

Turning Lift-Shaft Bearings

The illustration, Fig. 5, shows an ingenious arrangement for turning bearings on lift shafts. As the arms of the lift shaft are considerably longer than can be swung in the lathe available, a special device is necessary. The device illustrated consists of a train of gears attached to the carriage of a 36-in. engine lathe. The cutting tool shown at *A* consists of a ⅜-in. square tool, bolted to the side of a gear which is integral with the journal revolving in a bearing that is supported by the frame shown fastened to the lathe carriage. The shaft is inserted through the gear and swung between the lathe centers in the usual manner, one of the arms resting against the bed of the lathe. Power is supplied to the tool by means of an air motor which operates the train of gears and revolves the tool around the shaft at a speed of approximately 42 r.p.m. The desired feed is obtained by operating the carriage in the usual manner and ⅛ in. of stock can be removed at a cut. By using this device new lift shafts have been finished on both ends in from 3½ to 4 hr. and the bearings on old shafts finished on both ends in from 1½ to 2 hr.

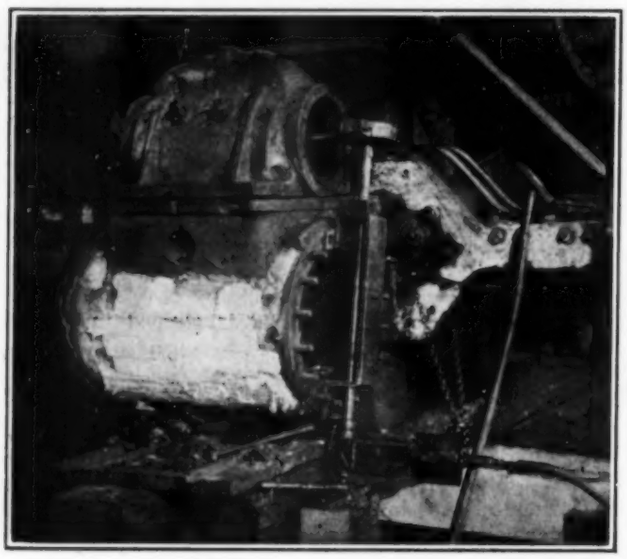


Fig. 4—Grinding valve chamber to valve face of cylinder

Fig. 6—Swaging superheater flue

A shop-made machine for swaging the ends of superheater flues is illustrated in Fig. 6. The principal parts of the machine are two sections of 10-in. channel iron which serve as the frame, and an 8-in. Westinghouse airbrake cylinder, set vertically between the channels as shown. Air is supplied from the air line through a three-way valve which acts both as intake and exhaust. The valve is connected to the upper die so that when the valve is opened and the air drives the piston down to a certain point the intake valve is closed and the exhaust valve is opened. The piston is now brought back by the action of a suitable spring which is back of the piston, inside of the cylinder, and when it reaches a certain height the intake valve is opened again and the action is repeated. The lower end of the ram is attached to a plate in which are four holes evenly spaced. Through each hole is inserted a stud which is screwed into a corresponding hole in the top of the die. The studs serve to

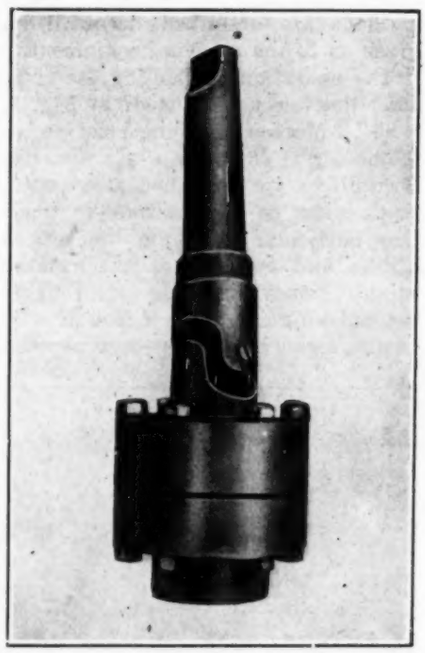


Fig. 7—Friction chuck for taps and reamers

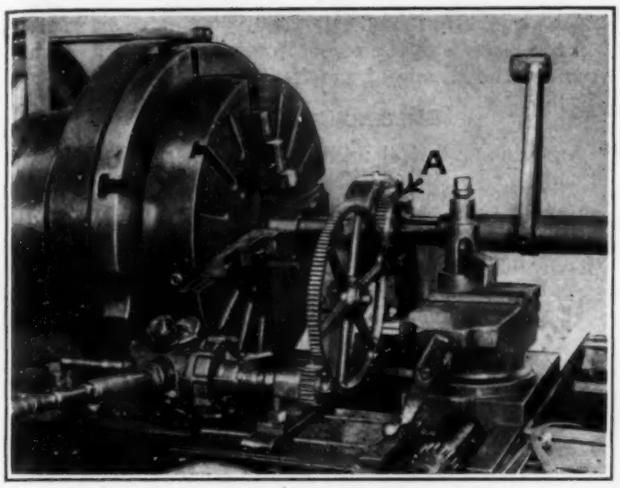


Fig. 5—Turning lift shaft bearings

hold in place four springs, by which arrangement a cushion effect is obtained. The ram makes approximately 500 strokes per minute. A superheater flue can be swaged in from 1½ to 2 minutes.

A friction chuck for use in holding reamers, taps, or similar tools is illustrated in Fig. 7. This chuck is very useful in reaming out holes in frame splices, back ends of main rods, and similar classes of work which require long reamers. A great deal of such work which was formerly done by hand and air motor is now performed with a drill press. The important feature of the chuck is the adjustable friction disk, which is responsible for a great saving in expensive reamers. Fig. 8 shows the tool disassembled. The lower end of the piece *A* rests on a leather disk in the bottom of the counterbored hole in *B*, and *C*, which is bored taper to correspond with the taper on *A*, slips down over *A* and is bolted to *B*. The taper shank is attached to the universal joint block by means of the two studs *D*, which slip through the two small holes in the lower end of the shank and screw into corresponding holes on opposite sides of the block. The part *E*, which is grooved across the bottom, is now slipped over a tongue in the bottom of *B* and the piece *F* is fitted over it and screwed into a corresponding threaded shoulder on the bottom of *B*. The piece is squared out to hold the shank of the tool, this construction making it possible to change the piece so that parts to fit any size of shank can be used.

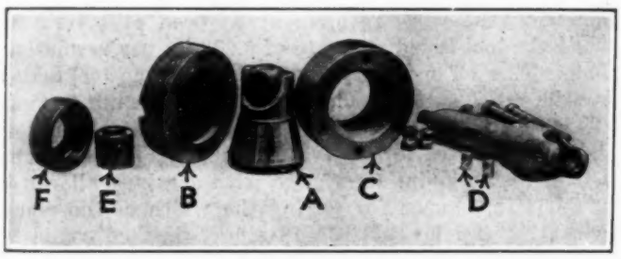


Fig. 8—Parts of friction chuck

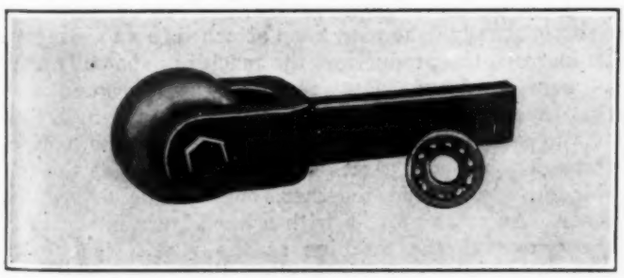


Fig. 9—Ball-bearing burnishing roller

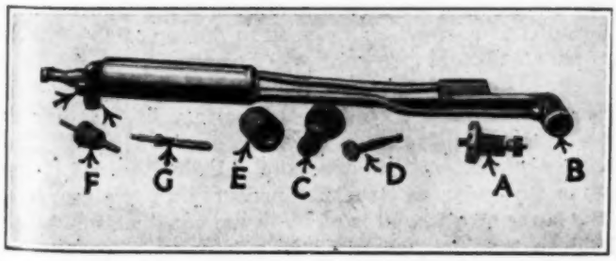


Fig. 10—Tools for reseating acetylene torch valve

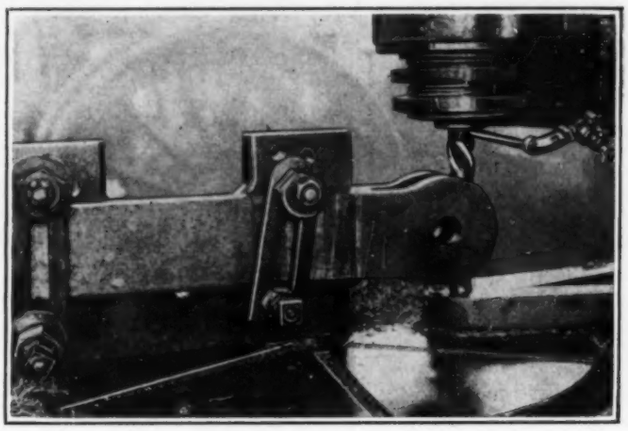


Fig. 11—Milling out end of side rod

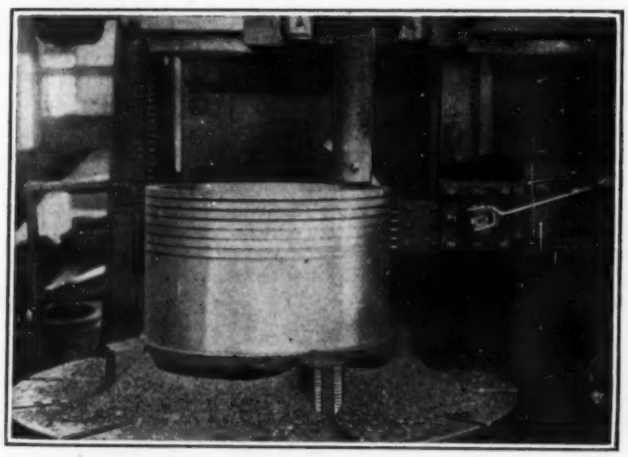


Fig. 12—Turning and cutting off piston rings

Another interesting tool is the burnisher used for finishing journal bearings, shown in Fig. 9. The tool consists of a hardened steel roller into which is fitted a standard locomotive turbine bearing. Bearings that have outlived their usefulness for turbine work are often good enough for this job. Approximately 0.001 in. is left on the roller pin and in the roller for a press fit for the inner and outer ball races, and after the tool is

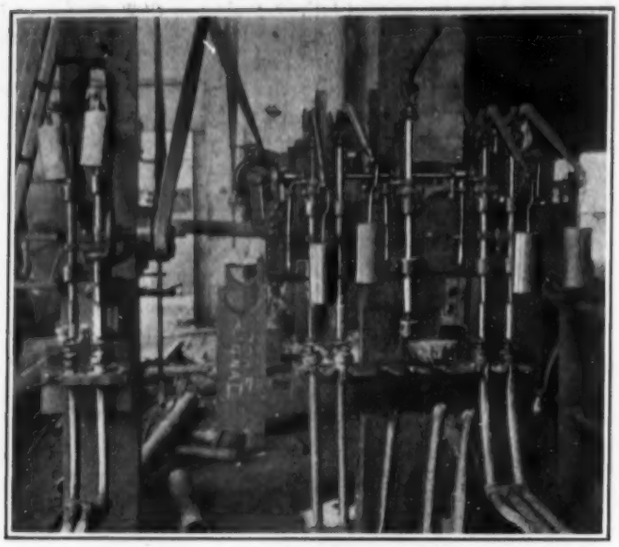


Fig. 13—Lapping joints on superheater units

assembled, the balls must be kept well lubricated. Six bearings have been in use in rolling tools in the Southern Pacific shops for from 2½ to 3 years, and have required no repairs.

The tools used for repairing valve seats in acetylene cutting-torches are shown in Fig. 10. The piece *A* with the cutter shank inserted through it as shown, is screwed into the cutting head *B* until the cutter rests on the valve seat. The cutter is revolved by means of a wrench, applied to the squared end of the shank. Pressure is applied by inserting a pin into one of the holes in piece *A* and giving the piece a slight turn, thus screwing it into the head.

The parts indicated at *C* are the sleeve and cutter used for reseating the internal nozzle *D*. The nozzle is slipped into the holder *E* with the stem protruding through a small hole in the bottom of the holder, far enough so that it can be gripped in a vise. The cutter *C* is now placed in the holder with the face of the cutter resting on the face of the valve, and the sleeve is screwed in to obtain the necessary pressure so that a cut can be taken. The cutter is revolved with a wrench in the same manner as the cutter *A*. The piece *F* is used for reseating the valve in the valve body (indicated by arrows) and the piece *G* is for reseating the cutting valve which is under the handle of the torch.

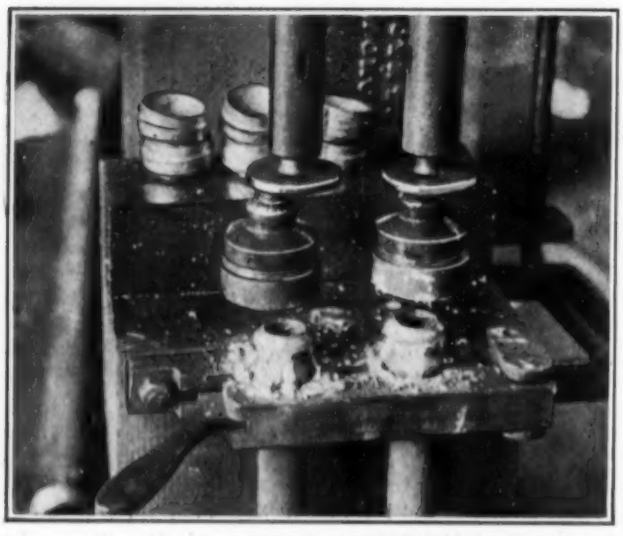


Fig. 14—Close-up view of lapping tools

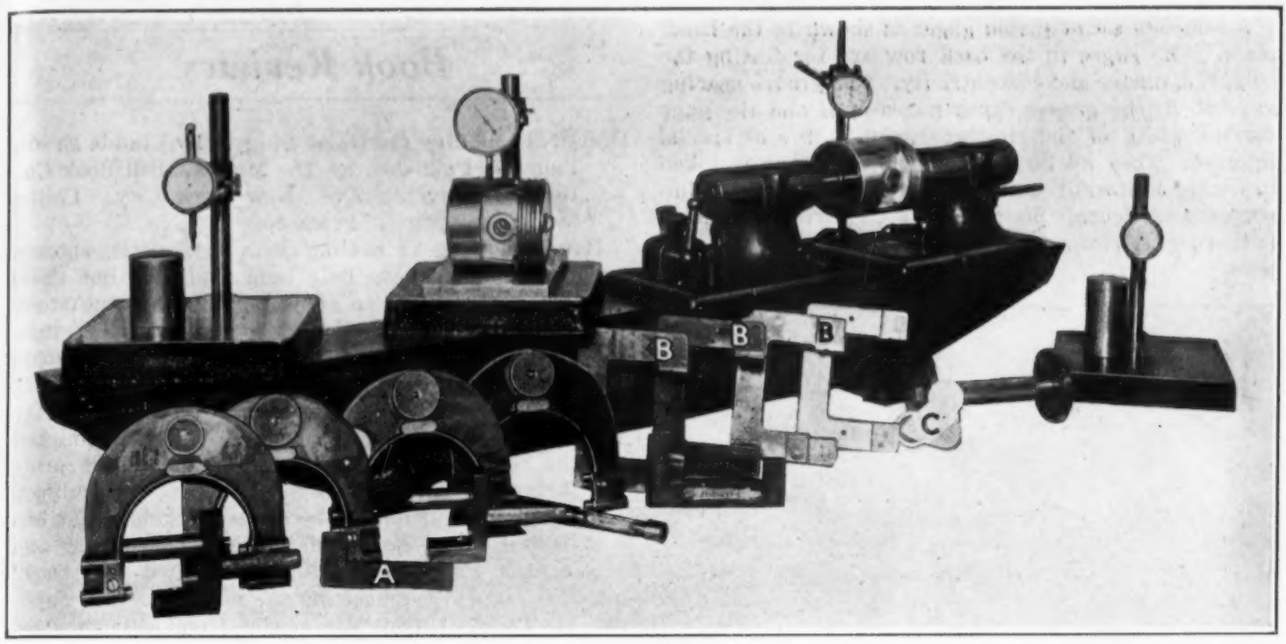
Milling Out Rod Ends

A Newton vertical milling machine is shown in Fig. 11, milling out the slot in the end of a forged steel side rod. The tool is a high-speed steel helical cutter, 2 in. in diameter, which is ¼ in. less than the width of the slot. The cutter is fed into the solid metal, cutting in on one side of the slot and out on the other. The spindle speed is 92 r.p.m., which is equal to a cutting speed of 48½ ft. per min. A rod can be set up and milled out in from 1½ to 2 hr. This machine also has a radius attachment with which links are milled and finished with spiral and face cutters.

The operation of turning, boring and cutting off cast-iron piston rings is illustrated in Fig. 12. The casting is turned and rough bored at the same time, then the set of five cutting-off tools is started cutting off the rings. The rings are not entirely separated from the castings, however; the cutting-off tools only go through as far as the stock that was left for the finish boring cut, which separates the rings from the casting as it proceeds. This method not only saves time, but also eliminates the crumbling of the inside edges of the rings that occurs when the cutting-off tools are allowed to cut all the way through. Approximately ¼ in. of stock is allowed on the outside and inside of the casting in the rough. The boring and turning tools are ¾-in. square high-speed steel. On the rough boring and turning operation the work revolves at a speed of 5.5 r.p.m., while the tool is fed at a rate of 0.033 in. per revolution. The cutting-off speed is 4.5 r.p.m., the boring tool taking a $\frac{1}{16}$-in. finish cut with 0.033 in. feed, while the cutting-off tools feed in at a rate of 0.011 in. per revolution. Calipers are used for gaging the outside and inside, and a double-step $\frac{3}{16}$-in. snap gage with a minus allowance of 0.004 in. is used for gaging the width of the rings. A casting can be cut into 18 rings, finished complete, in 3 hours.

Lapping Superheater Unit Joints

The operation of lapping the joints on superheater units is usually done with a lap attached to an air motor. To increase the production, the machines shown in Fig. 13 were developed. Each machine has two spindles so that the two joints on one end of a unit can be lapped at the same time. Power is applied to one spindle through a belt and a set of bevel gears, and as the two spindles are geared together, one spindle drives the other. An extra spindle with a hand lever is shown in the center of the machine at the right. The extra spindle is used for trimming when the surface is too bad for grinding. Pressure is applied by the weights on the front ends of the arms which project over the tops of the spindles, each arm being hinged to a support at the back of the machine, and pinned to the top of the spindle so that sufficient pressure will be exerted on the tool. A cup-shaped opening on the top of the lap-holder is closed in around a ball on the bottom of the disk to which the shank is attached as shown in Fig. 14. The ball is off-center so that as the spindle revolves it imparts a regular motion that produces an oval surface. The lap is of lead and is of the usual construction, being held to the tool by means of a knurled ring. A fine grade of abrasive mixed with oil is used for grinding the joint.



Maxwell Method of Securing Accurate Pistons

By Fred H. Colvin
Editor, *American Machinist*

A novel chuck by which the piston is squared with the piston-pin hole before the final turning—The gages used in measuring checking and grading

WE ARE learning that the piston affects both the smooth running of a motor and its life to a very marked degree. One of the vital factors is the squareness of the piston-pin hole with the outside of the piston, as a piston in which the hole is out of square is capable of making all kinds of trouble.

In order to secure the desired squareness of the piston-pin hole, the Maxwell Motor Corporation has devised a very ingenious method of correcting any inaccuracy before the final turning of the outside of the piston. This is accomplished by the use of the special chuck shown in Fig. 1, and in detail in Fig. 2. After the piston has been rough bored and turned and the piston-pin hole finished reamed within 0.002 in. of the finished size, it comes to the machine shown for correction. The hole in the chuck on this machine is larger than the piston, as can be seen. The piston is put in place and the plug *A*, Figs. 1 and 2, pushed through the piston-pin hole.

Then the center *B*, Fig. 2, is moved forward by the air chuck on the lathe, and holds the piston by the center and against the mandrel in the piston-pin hole. With the piston thus held square with the hole, the outer end of the skirt is refaced and beveled by the tool *C*, Fig. 2. This brings the center in the head and the end of the skirt square and true with the piston-pin hole. The piston is then finished on centers with the assurance that the outside will be square with the hole.

In Fig. 1, will be seen a heavy angle block *B* carrying both a dial indicator and a positive stop for the turret slide, making it easy for the operator to face the end of the piston skirt to uniform length, which assists greatly in securing pistons of uniform weight, for each motor.

Referring again to Fig. 1, it will be seen that there is a cam behind the chuck, at *C*. This is a time saving device to enable the operator to stop the lathe spindle quickly and in the correct position for handling the work in and out of the chuck. The brake *D* is operated by a treadle, and when forced against the cam, stops the spindle so that the knob of the plug, *A*, is in a convenient position for the operator.

After finishing the outside, the pistons go to the inspection bench shown in Fig. 3, for final grading as to outside diameter. There are five ring gages, varying by half-thousandths. Care is taken to maintain an even temperature in this department, to insure accuracy. The gage at *A*, tests the squareness of the hole with the outside.

A complete set of piston gages is shown in the headpiece. The gages in the back row are for testing the height, diameter and concentricity. The groove spacing gage at *A*, the groove depth gages at *B* and the gage for the width of the ring groove at *C*, are of special interest. They all go to show the care that is taken to secure uniformly accurate pistons and that the importance of accurate pistons as a vital part of the motor is thoroughly realized by men responsible for performance.

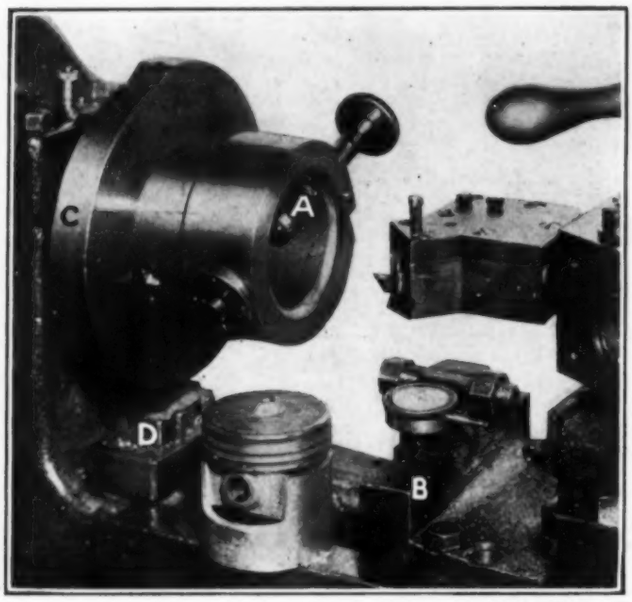


Fig. 1—Method of squaring piston with the pin hole

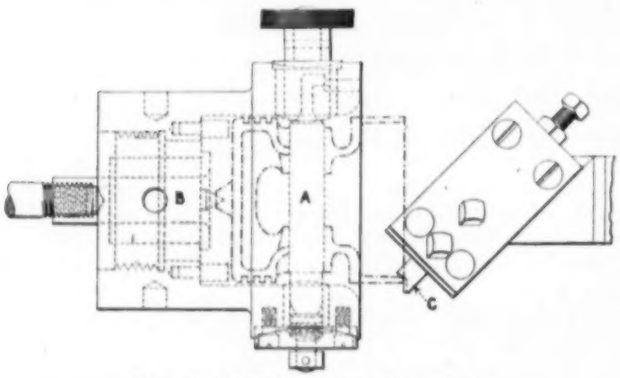


Fig. 2—Details of special chuck

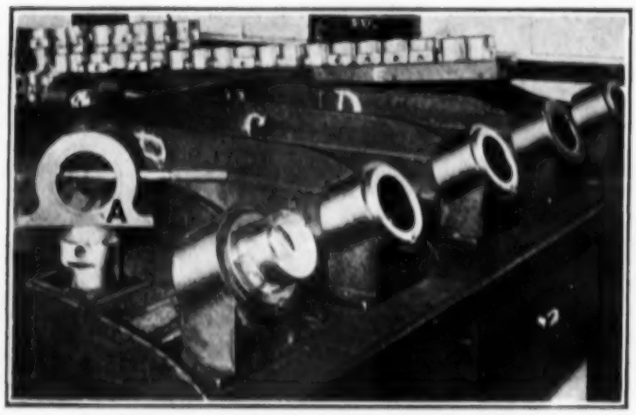


Fig. 3—Grading pistons into five sizes

Book Reviews

Practical Calculus for Home Study. By Claude Erwin Palmer. Published by The McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Cloth; 5x8 in., 437 pages. Price, $3.

Home-study books dealing with arithmetic, algebra and trigonometry have long been available, but those who had mastered these subjects through home study were generally obliged to use the regular college textbooks if they desired to study calculus. No one could be better fitted to remedy this situation than Claude E. Palmer, who has had much experience in meeting the special needs of the home student. The author does not call the book "Calculus Made Easy," the reason probably being that there is no royal road to this subject. Yet calculus can doubtless be mastered at home by one who is fairly well grounded in algebra, geometry and trigonometry. While avoiding the stilted "textbook" presentation and emphasizing the many practical applications, the book does not depart from sound mathematical fundamentals. Both differential and integral calculus are covered. Many problems, the answers to which are given in the back, increase the usefulness of this book. There are also extensive tables of integration formulas, trigonometrical formulas and logarithms.

Foundry Work. By W. Roland Needham. One hundred forty-two pages, 5x7 in., cloth boards. Illustrated. Published by Blackie & Son., Ltd., 50 Old Bailey, London, England. Price 2 shillings, 6 pence.

A book that should prove valuable to apprentices who have practical examples about them continually. From it the apprentice can learn "why" much more readily and thoroughly than he can from his sources of information in the foundry.

The text and illustrations should be of great assistance to the instructors in school foundries as a frame-work upon which to build a course, and as supplementary reading for the student.

The author presupposes a rather extensive vocabulary on the part of the apprentice, for whom he has set out to write a primer. Possibly the English foundry cub could manage, but the average American apprentice would need more than a little help from his dictionary.

There is not a great difference between English and American foundry terms, and the apprentice who is genuinely interested in his work can supplement, with advantage, his American texts by Mr. Needham's book.

Popular Research Narratives. Collected by the Engineering Foundation, 29 W. 39th St., New York City, and published by the Williams & Wilkins Co., Baltimore, Md. One hundred forty-nine pages, 5x7 in. cloth boards. Price 50c.

Engineering Foundation has issued from time to time four-page leaflets, each containing a short story of research. Not more than five minutes is required to read any one of them, and the information they contain makes them truly valuable. Best of all, the stories are told in an attractive style not usual in scientific writings.

The first fifty of the research narratives have been published in the little book, of which the main title is given above. The full title is "Popular Research Narratives; Tales of Discovery, Invention and Research."

Development of Machine Tools in New England

By Guy Hubbard

The seventeenth article—More of the Robbins & Lawrence apprentices—Drawings of machine tools in colors—Interchangeable work at Harper's Ferry

ANOTHER of the Robbins & Lawrence apprentices was a nephew of Asahel Hubbard, the inventor of the revolving hydraulic engine and founder of the chain of machine industries at Windsor. George Watts Hubbard, whose portrait is shown in Fig. 118, was born at Windsor in 1836, and while a school boy there, he indicated his mechanical tastes by spending considerable time with his cousin Nicanor Kendall, in the shops of Robbins, Kendall & Lawrence. At the age of seventeen the boy was placed in the office of the Robbins & Lawrence Co. as an apprentice draftsman under the kindly tutelage of Frederick W. Howe. After a year of this work, the apprentice saw the advantages of science and higher mathematics to the designer, so he entered Norwich University where he studied engineering for two years, as a contemporary of George Dewey —the future admiral. During this time he continued his work with Mr. Howe during the holidays.

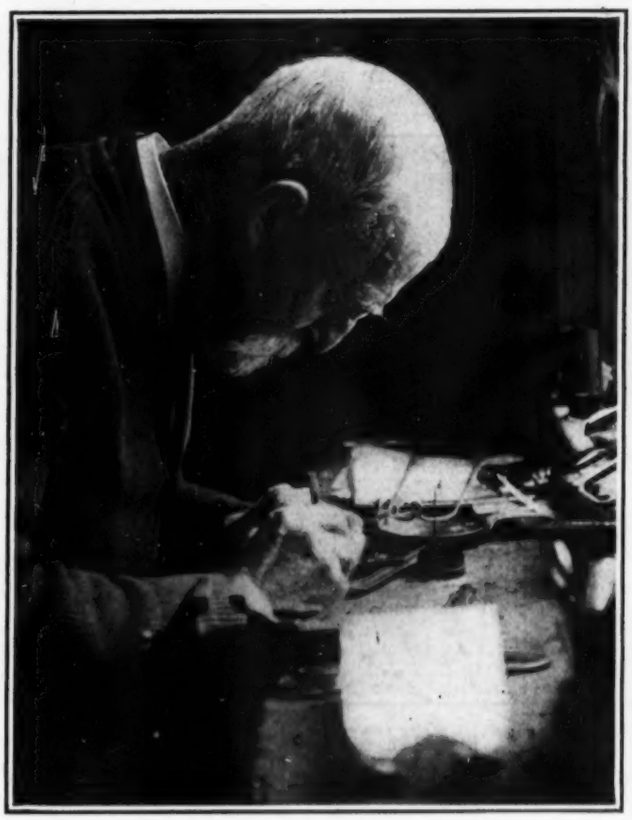


Fig. 118—George W. Hubbard
(Taken at his experimental bench in his 80th year)

After leaving Norwich in 1855 George Hubbard started in at the bottom by entering the so-called "Big Shop" of the Amoskeag Manufacturing Co., at Manchester, N. H., see Fig. 119, as an apprentice machinist at 50c. per day. His work in this shop ranged all the way from that upon delicate textile machinery to locomotives, and was splendid practical training. Meanwhile, he continued to practice drafting in the evenings, and eventually one of his drawings of the internal workings of a Robbins & Lawrence revolving hammer pistol, came to the attention of William C. Pickersgill, the chief draftsman. Mr. Pickersgill, who was a Welshman and had studied under the early English tool builders, had the apprentice transferred to his department and took pains to teach him those finer arts of making elaborate drawings in shade and water color. At this time George Hubbard became the roommate of another of the young draftsmen who spent all his spare time modeling in clay. This amateur sculptor was none other than John Rogers, who became famous as the creator of the "Rogers Groups," and it was this same artistic engineer who years later modeled the symbolic figure which overlooks the city of Hartford from the dome of the State Capitol.

In 1856, William B. Bement, born on a farm in Bradford, N. H., scarcely twenty miles from Windsor, and who was one of the early Amoskeag workmen, came to see his old friend William Pickersgill about an assistant, and as a result, the Philadelphia machine builder took young Hubbard home with him. While working for Bement & Dougherty, George Hubbard lived at the home of Mr. Bement. One day in January, 1922, Clarence S. Bement (since deceased), sometime president of William B. Bement & Sons, and a director of the present Niles-Bement-Pond Co., spent an afternoon telling the writer of the pleasant times which he, as a schoolboy, spent in company with George W. Hubbard (the writer's father) nearly seventy years ago.

In 1860, George V. Cresson, who was another of Mr. Bement's young assistants, and George Hubbard set up a shop of their own at 1509 Pennsylvania Avenue under the name of Cresson & Hubbard. During the civil war this firm built special machinery, demountable mountain guns, and also a time fuse for bombs, which was invented by Mr. Hubbard and successfully tried out under the direction of the young inventor in the

For the author's forthcoming book. All rights reserved.

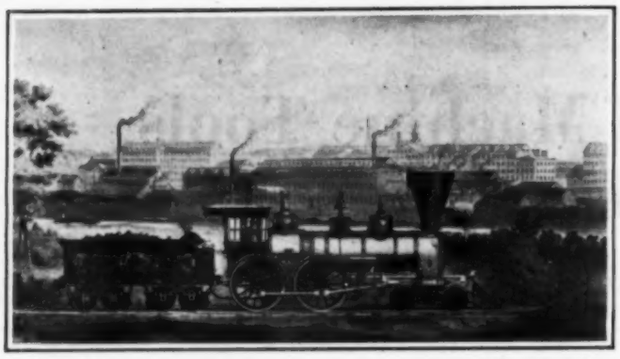


Fig. 119—The Amoskeag shop in 1855, with one of its passenger locomotives in the foreground

railway mortars during the seige of Richmond. Cresson & Hubbard also constructed for Prof. John Wise, a hand driven propelling apparatus for his early dirigible balloon. Upon the close of the war, this concern as Cresson, Hubbard & Smith began the manufacture of standard pulleys and hangers, and built up an industry which later, as George V. Cresson & Co. and the Cresson-Morris Co. is well known in that field today, and is one of the older machine industries of Philadelphia.

Mr. Hubbard sold his interests in this business in 1867, and until 1876 was associated as mechanical engineer with Henry G. Morris of the Southwark Foundry in Philadelphia, and with Mr. Scott in the Union Iron Works of San Francisco, for whom he superintended a large installation of mining machinery at the Comstock Lode in Virginia City, Nevada.

In 1876, as an unexpected outcome of experiments upon boilers, Mr. Hubbard invented that familiar household utensil—the coffee percolator—and started a shop at Windsor for its manufacture. This he followed in 1880 by the diamond-shaped glaziers' point and driver which have since revolutionized the method of glazing sash all over the world.

When, in 1888, the Jones & Lamson Machine Co. decided to move from Windsor to Springfield, Vt. Mr. Hubbard was one of those who kept the wheels turning in Windsor by founding the Windsor Machine Co. to take over the old Robbins & Lawrence shops. From 1888 to 1890 he served as managing director of this concern. Mr. Hubbard died at Windsor in 1918. In 1858, at the age of twenty-two, this Windsor mechanic became a medallist of the Franklin Institute as a result of his colored drawings of tools exhibited by Bement & Dougherty.

The Last Connecting Link

The last survivor of the numerous Robbins & Lawrence organizations appears to be Frank A. Chase, who at the time of writing is living in Los Angeles—hale and hearty at the age of eighty-eight. Mr. Chase began to learn his trade at the Windsor armory in 1851, where he became a shopmate and lifelong friend of Charles E. Billings. His first job there was to polish the shafting and couplings made for the new Sharps plant at Hartford, and his last was as contractor for the ramrods for the Enfield rifles, for which he invented many special tools. After the failure, Mr. Chase went west as a railway mechanic and, in nearly fifty years of this service, he rose to be general master mechanic and general mechanical inspector of the Chicago, Burlington & Quincy lines, east of the Missouri River. Mr. Chase has corresponded with the writer during the preparation of parts of this article, and has also been of

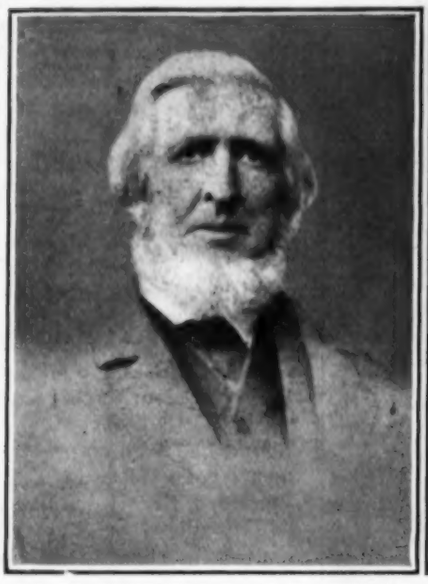
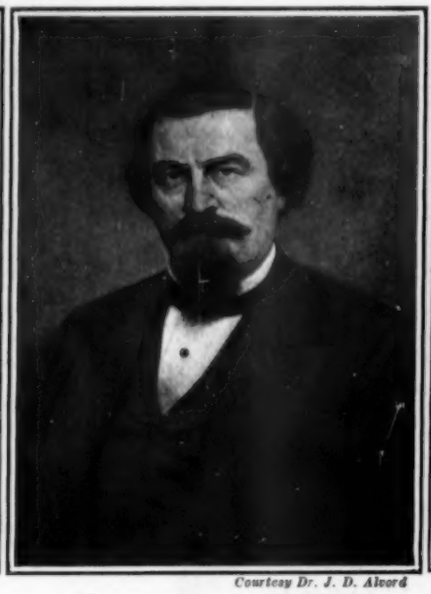


Fig. 120—Christian Sharps



Courtesy Dr. J. D. Alvord

Fig. 122—Joseph D. Alvord

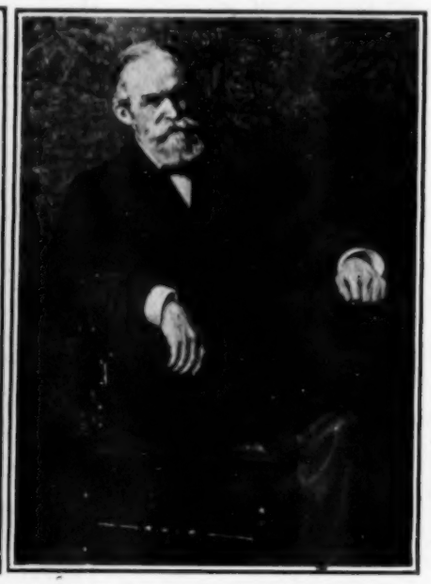


Fig. 123—Hezekiah Conant
(From portrait by Maria Brooks)

Fig. 121—The Sharps & Hankins armory, Philadelphia

invaluable assistance in checking and correcting them.

Of the Sharps organization four men were outstanding figures, the first being Mr. Sharps, himself. Christian Sharps, see Fig. 120, was born at Washington, N. J., in 1811, and received his education and early mechanical training in that town—serving his time as an apprentice gunsmith and machinist. About 1830 he entered the employment of Capt. John Harris Hall in the so-called "Hall Shops" on the island at the Harper's Ferry armory. Here Captain Hall, about 1820, had begun for the U. S. Government, the interchangeable manufacture of the Hall breech loading rifle, developing one of the earliest complete installations of machinery for interchangeable manufacturing. Thus it was that under the Maine backwoodsman who invented the earliest breech loading U. S. Army rifle, there developed the inventor who was to bring out a still more famous arm of the same type.

After the closing of the Hall shops in 1840, Mr. Sharps, who was now an experienced mechanic, went to Cincinnati where he set up as one of the earliest inventors and machinists in this future center of the machinery industry. He took out many patents on various articles, and finally, in 1848, he patented the sliding breech rifle, which bears his name. This invention was inspired by the earlier Hall breech loader with which he was so familiar.

After the establishment of the Sharps Rifle Manufacturing Co. at Hartford in 1851, Mr. Sharps removed to Hartford, and until the outbreak of the civil war he was a contractor and inventor for this company. In the meantime, he had invented a four shot revolving-hammer pistol, and a new breech loading rifle in which the barrel slid forward on the frame, for the purpose of loading with the rim fire or center fire cartridge.

Upon the outbreak of the civil war, Mr. Sharps, in partnership with a gunsmith by the name of Hankins, organized at Philadelphia the carbine and pistol manufactory of Sharps & Hankins, see Fig. 121, where these new arms were built for several years in considerable numbers. Mr. Sharps, during the civil war, divided his time between the Hartford and Philadelphia factories and during the last of the war, by simple changes, he adapted the sliding breech rifle to metallic ammunition.

Retirement from Business

After retiring from business, about 1870, Mr. Sharps bought a large estate in the Bolton hills in the town of Vernon, Conn., and established there an extensive trout hatchery—one of the first in this country. He died suddenly on this estate in 1874.

Joseph Dana Alvord, see Fig. 122, who is classed as one of the foremost exponents of the interchangeable system, was born at Westhampton, Mass., in 1824. Early in life he showed signs of mechanical genius, and entered the shops of N. P. Ames at Chicopee, where he learned the trades of patternmaker, toolmaker, and gunsmith. He developed great skill and, following his apprenticeship, he was employed for more than eight years as a first class workman at the Springfield armory.

When Robbins & Lawrence established its Sharps rifle manufactory at Hartford in 1851, Mr. Alvord and his associate, James Wilson, went there as contractors at the invitation of Richard S. Lawrence, the master armorer. Here Mr. Alvord remained until 1857, gaining the reputation of being one of the finest mechanics in Hartford. He introduced many improved methods and machines at the Sharps plant—among others an early adaptation of the turret lathe.

When the Wheeler & Wilson Co. moved its sewing machine business from Watertown, Conn., to Bridgeport in 1857, it offered Mr. Alvord and Mr. Wilson a contract to manufacture in its new plant at Bridgeport, certain complicated parts of its sewing machines. This offer was accepted, and for many years Mr. Alvord had several hundred men in his employ at the Bridgeport factory, was responsible for many improvements upon the sewing machine, and introduced many improvements in interchangeable manufacturing methods which are still in vogue. George M. Eames, the works manager of the Singer Manufacturing Co. says of Mr. Alvord, whom he well remembers:

A Tribute to Ability

"He was an exceptionally able man, both as a manager and as a progressive mechanic, and many of the principles of tool building that he introduced into the early history of sewing machine work have been copied and extended so that they are now the regular procedure in the art of tool building. As a detailed illustration, I believe J. D. Alvord to be the originator of the spring pin as a support in jig and fixture building. He also built some very ingenious devices for form and irregular milling."

Mr. Alvord died rather suddenly in 1877, and on account of his generous disposition and kindly acts, as well as for his mechanical ability, his loss was deeply felt.

Rollin White, who was the pioneer inventor of the Smith & Wesson Revolver, was born at Williamstown, Vt., in 1817. After serving his apprenticeship, building textile machinery, Mr. White turned his attention to firearms and one of his first inventions in this direction was a multiple shot pistol, having a single barrel and a magazine holding six charges, which was fed along automatically as the hammer was cocked.

Mr. White entered the employment of the Sharps Co., as gunsmith and inventor, early in its career at Hartford, and was the inventor of the knife-edged breech block in the Sharps rifle, which dispensed with biting off the paper cartridges. He also invented a self-cocking device for this arm.

While at the Sharps plant, Mr. White conceived the idea of boring holes in the cylinder of the old style Colt revolver, entirely through, so that metallic cartridges could be inserted at the rear. This was patented, and Smith & Wesson immediately became licensed under the patent to build revolvers on this plan. This valuable patent was the subject of numerous infringements, and Mr. White fairly wore himself out fighting for his rights from one court to another, winning consistently, but spending thousands of dollars and the best years of his life in doing so.

In 1864, Mr. White moved to Lowell, where he invented and patented many important improvements in firearms, cartridges, cartridge and textile machinery, which are in use in the cartridge and textile factories of that busy city. He died at Lowell in 1892.

Hezekiah Conant, see Fig. 123, a direct descendant of Roger Conant (1592-1679), the first Governor of the Massachusetts Bay Colony, was born at Dudley, Mass. in 1827, where he attended the public schools and received his early mechanical education. He became a draftsman and inventor, and as such was employed for

several years at the Sharps works in Hartford under Mr. Lawrence. While there it was his fortune to teach the art of drafting to Christopher M. Spencer, the instruction being given in the evenings while that future famous inventor was employed at Colt's armory.

In 1858, while Mr. Spencer was working as mechanic at the silk mills of Cheney Brothers, South Manchester, Conn., he invented an automatic machine for winding silk thread on spools and exhibited it to Mr. Conant, who was then working for the Willimantic Linen Co. as designer of special machinery. The result was the improvement of the device by Mr. Conant, who later purchased the patent from Mr. Spencer. This so-called Willimantic thread winder was the first machine built by Pratt & Whitney in its original shop in Hartford, in 1860.

This joint invention of Mr. Spencer and Mr. Conant had a deep effect upon the thread industry, for it is not only what brought the Coates Co. of Belfast to the United States, but also led Mr. Conant to become the founder of the Conant Thread Co., of Pawtucket. At the time of his death in 1902, Mr. Conant was one of the leading citizens of Pawtucket.

Testing Locomotives on a "Slip-Track"

By R. E. Marks

The San Bernardino shops of the Santa Fé system are in a transition stage. A new addition to the machine shop gives a wide bay which is nearly all glass and is served by a 15-ton crane. The toolroom is considerably enlarged and new machines are on the way. The apprentice school building is to be torn down and a newer and larger one built. A new power house is under way, the most prominent feature being a cement stack, considerably over 200 ft. high, which stands out against the mountain as a background.

One of the interesting features of this plant is the "slip-track" on which engines that have been overhauled are broken in and tested. The old and usual way was to run them over a division slowly and watch for defects. But sometimes conditions arose which made it necessary to speed up to get out of the way of regular trains. This frequently meant heating bearings somewhere, and occasionally some damage was done before the locomotive could be stopped at a junction and run on a siding.

The "slip-track" is just what the name implies. A track on which the locomotive is allowed to run just as in service, but on which it slips freely, although it allows the locomotive to run just as in actual service for perhaps a mile, including a reverse curve so as to give the locomotive side motion and test out the hub liners and thrust plates.

The locomotive to be tested is provided with pipes that flow oil on to the track under the drivers so that they slip quite freely, allowing a high rotative engine speed if desired, with a slow forward movement. This test develops all the rattles, pounds and slaps possible, and makes it easy to locate each defect. Then, too, if heating develops at any point, it can be quickly detected without fear of getting in the way of a regular train. Any necessary work can be promptly done by a machinist from the shops nearby.

Many interesting devices for expediting work have been designed and put into use. Efforts are made to shorten the stay of a locomotive in the shop by anticipating in so far as possible the repairs to be made. New crankpins are made in advance, to standard sizes, only the wheel fit being left unfinished. This part of the pin is rough turned as nearly as practicable to size, the final fitting being done by measure of the hole after the old pin has been forced out of the wheel.

The electric arc welder is used to fill in wheel hubs that have become too large for a good fit on the axles. It has been found practicable to first bore a little out of the wheel, then fill in with metal and rebore to standard size. By boring the wheel before filling in, a little thicker layer of new metal is secured.

Piston Rings and Ring Grooves—Discussion

By James McIntosh

On page 554, Vol. 60, of the *American Machinist*, Frank C. Hudson, in an article under the title given above, lays great stress on the distortion of piston rings, due to holding them in a magnetic chuck when facing the sides. In the case of individually-cast rings, where the molds are dumped while the castings are red hot, distortion must result and if such rings are held in a magnetic chuck for facing, the distortion will not be wholly removed.

In the case of rings cut from a long sleeve and parted with a proper gang of tools, there is usually one side of each ring free from fins, and care should be taken to place that side next to the magnetic chuck. This will eliminate distortion while facing.

The sides of the grooves in a piston finished with sharp tools, should not cause trouble where the rings fit the grooves properly, and even where a little clearance is controlled by the oil film, there is little chance for rings to hammer and widen the grooves.

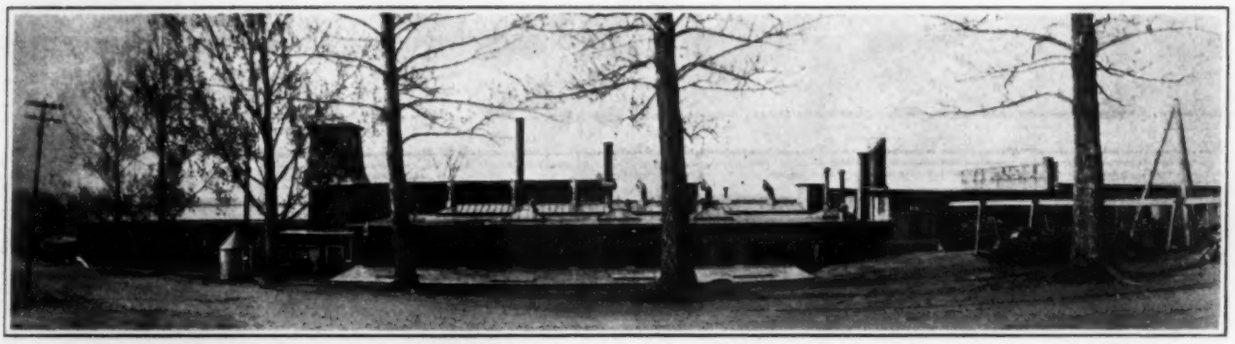
In the case of an aluminum-alloy piston, a suitable disk roller can be used to close the grain and harden the sides of the grooves but for a cast-iron piston of the usual composition, there is little occasion to improve the faces. Mention is made of piston rings $\frac{1}{8}$ in. wide but the rule is more often $\frac{1}{4}$ in. and a ring the latter width is a simple problem to produce when proper materials and methods are used.

The multiplicity of designs on the market, each claiming some special virtue, seem to point out that the manufacture of piston rings to fit the bore is not very well understood. They can't all be best nor is there any special problem for each case. With a standard engine design there can be a standard for the piston rings.

The first essential is that of a satisfactory material, kept uniform as to characteristics at every point of the casting. That means castings should be allowed to remain in the mold until they are at least cool, otherwise there is sure to be distortion and what is perhaps worse, several grades of hardness due to local cooling in spots, while there is a possibility of soft spots due to the points of contact in a pile of red hot castings cooling off in a draft, perhaps.

How many rings fail, due to defective material and why few motor makers attempt to make the rings they use, can be only a guess.

It is quite evident that the machining of good, reliable piston rings is a problem. Seeming accuracy of rings is not their only measure of usefulness—they must fit the cylinder bore after they are in place.



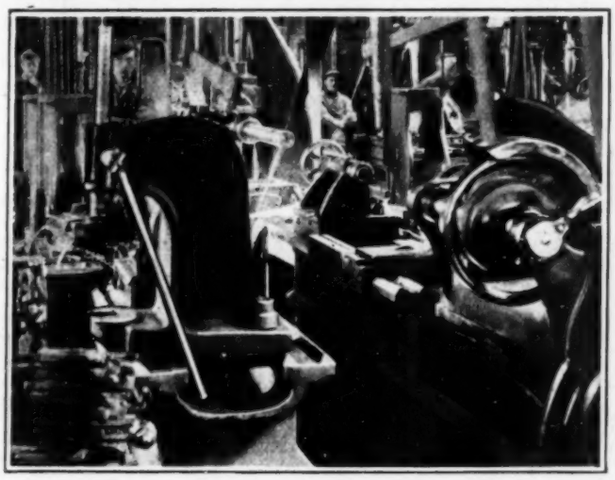
Where Machine Tools Are Made

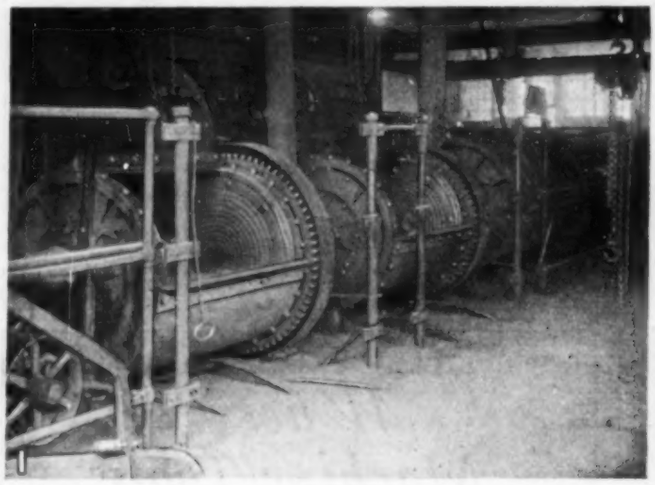
Fay & Scott

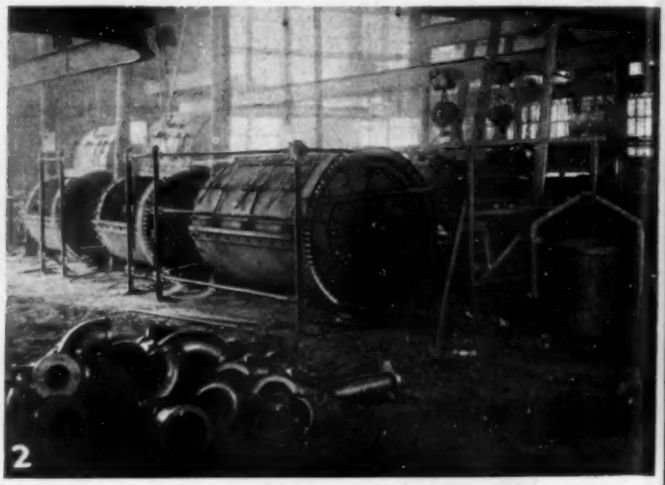
Dexter, Maine

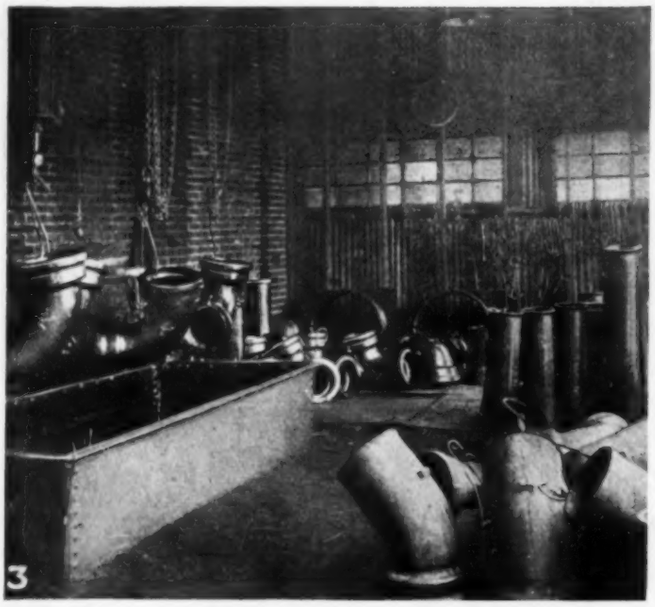
Founded 1881

General view of plant, the foundry, part of the lathe department. sub-assembly and final fitting of machines









Handling Pipe Work

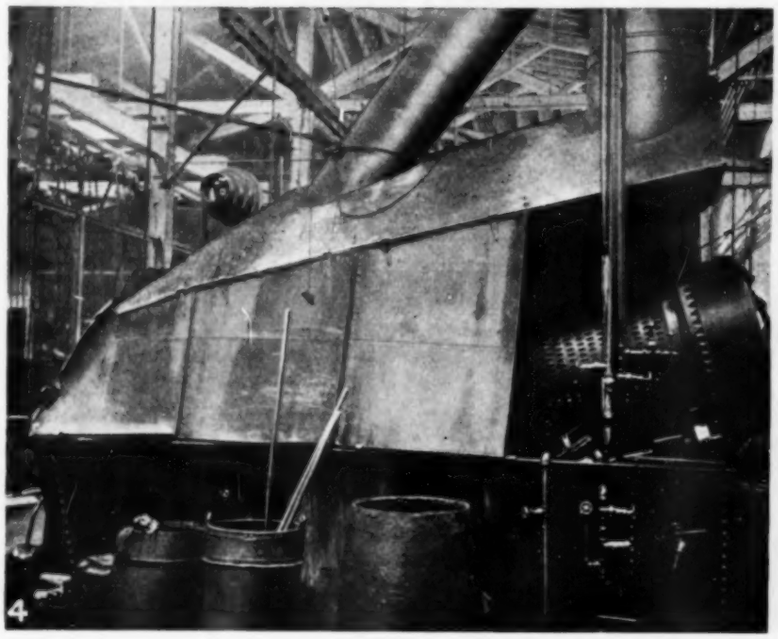
Fig. 1—A battery of tumbling barrels

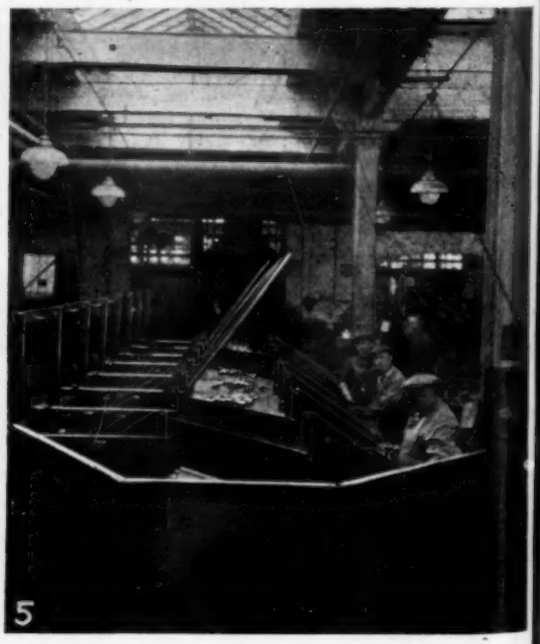
Fig. 2—Barrels and handling buckets

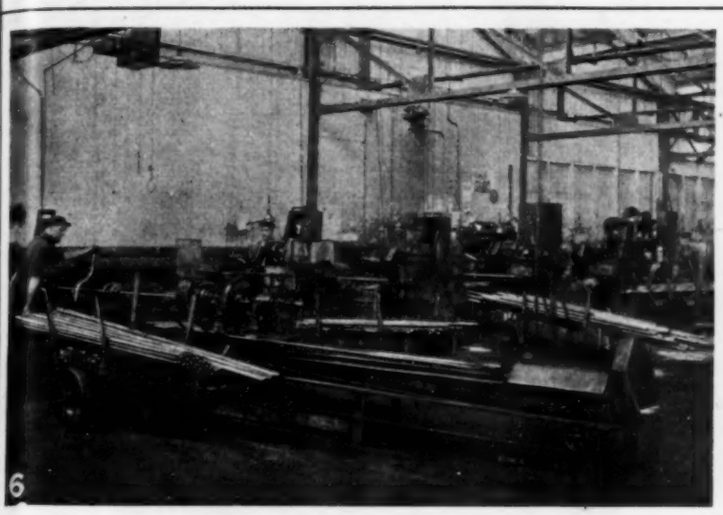
Fig. 3—Dipping socket fittings

Fig. 4—Where parts are washed

Fig. 5—Sorting work from washer







on a Large Scale

Fig. 6—Threading both ends of a pipe

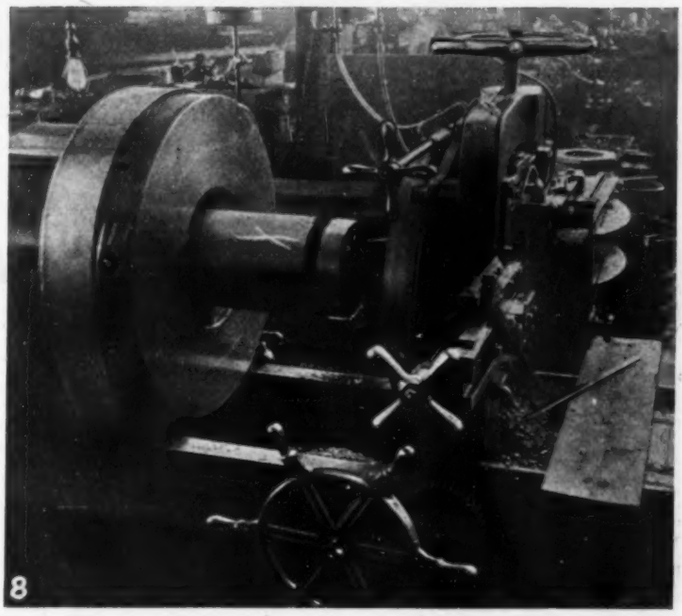
Fig. 7—Getting pipe ready to ship

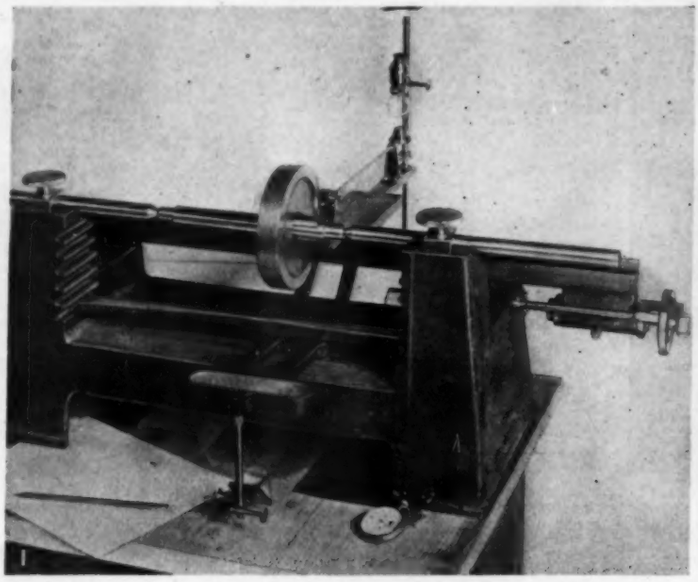
Fig. 8—An 18 in. pipe cutter on 14 in. pipe

Fig. 9—Where the pipe is stored

Fig. 10—Lifting pipe with magnet

Photographs from General Fire Extinguisher Co.





Activities in the Bureau of Standards

Fig. 1—Optical thread gage

Fig. 2—Baking enamelled metal ware

Fig. 3—The Northwest building

Fig. 4—Heavy experimental rolls

Fig. 5—Stirring machine for optical glass

How to Estimate Machine Shop Costs

By Albert A. Dowd

Determination of machining time for the estimate — Calculation of machine speeds — Cutting speeds for various materials—Factors governing selection of feeds

THE time necessary for manufacturing a given piece of work is an important factor in estimating the cost of production. Having decided upon a method of manufacture, laid out operations and made sketches of the necessary tools, as explained in the previous articles, these data are turned over to the time-study men who estimate the time required for the work. A great deal naturally depends upon the class of work involved, but in any case certain matters must first be considered before proceeding with the time studies.

The kind of material to be machined is an important factor in time study as it determines to some extent the speeds and feeds which can be used in machining. In estimating work it is important that the time study should be based upon speeds and feeds which are conservative enough to allow for such contingencies as hard castings, tough forgings, or alloys whose composition may be more or less of an unknown quantity. On any work involving the cutting of large quantities of special alloys that have not been tested, it is advisable to procure a sample of the material for a test before making the estimate. This is not always possible and, therefore, if there is any doubt about the matter, a statement should be made in the estimate to the effect that the estimate is based on the assumption that the material is of such a nature that it will permit a certain cutting speed.

Impracticability of Fixed Rules

It is not possible to give fixed rules for machining different kinds of material because the shape of the work, the tools used, and many other factors have an influence on the matter. For example, a piece of cast iron 6 in. in diameter may normally permit a cutting speed of 60 ft. per min. with a feed of 0.040 in. per revolution, using high speed tools. With stellite tools, however, a cutting speed of 80 ft. per min. may be possible under certain conditions, providing the casting is well pickled, annealed and sand-blasted. If the casting is very hard or of thin section, or if there are interruptions in the cutting action, it may be necessary to reduce the speed to 45 or 50 ft. per minute. A table is given herewith which can be used as a basis for estimating production time but it should be thoroughly understood that the speeds specified are for normal conditions when the amount of material to be removed is in accordance with standard practice. The writer has found that for a great deal of work the figures given are sufficiently conservative to give satisfaction.

This is the sixth article. The fifth article was concluded on page 797, Vol. 60, No. 22.

The tools to be used in the manufacture are shown on the layout sheet which has been turned over to the time-study men and the use of high-speed steel tools and cutters would ordinarily be assumed, unless stellite might prove more suitable. If no mention has been made of the matter on layout or operation sheet, the time-study man can use his judgment as to selection, but he is naturally governed to some extent by the practice in the factory where the work is to be machined. The design of the tools to be used must be taken into consideration by the time-study man and his estimate must be based on their application in the manner suggested. Slight changes in the arrangement or sequence of tools may be found advisable, in order to keep a continuous cutting action on the work with as little lost time as possible.

Accuracy Required Affects Time Study

The accuracy required on the work strongly affects the time study. In work requiring great accuracy the highest speeds and feeds are not always permissible, and more time is required if shoulder distances or milled surfaces are to be held within very close limits. In turret lathe work and in turning or facing shoulders, where great accuracy is specified, more time must be allowed for the operator to make sure of his sizes. So also in second-operation work when dimensions are closely tied up with previously machined surfaces, the setting up time allowance must be longer on account of the care necessary.

The time-study man who figures the production time on a piece of work must, of course, be thoroughly familiar with the meaning of the term "cutting speeds." Briefly stated, the cutting speed is the number of feet of metal which passes by the cutting point of the tool in one minute. In a turret lathe operation, the work revolves and a ribbon of stock is removed by the tool as the work passes it, while in a milling operation the cutters revolve as the work is fed slowly toward them.

Let us assume, for example, that a piece of work 20 in. in diameter is rotating at 10 r.p.m., and we wish to know what cutting speed is being used. It is evident that the circumference of the work in inches multiplied by the number of revolutions per minute will give the number of inches which pass the cutting tool in one minute, and this value divided by 12 will be the cutting speed in feet per minute. This is easily expressed in the formula:

$$C = \frac{D \times 3.1416 \times N}{12}$$

in which

C = cutting speed in feet per minute;
D = diameter of work;
N = number of revolutions per minute.

Applying this formula to our problem we have:

$$C = \frac{20 \times 3.1416 \times 10}{12} = 52.4 \text{ feet per minute.}$$

For another example let us consider a 6-in. cutter employed on a milling operation. The cutting speed would in this case be determined by the sumber of revolutions of the cutter multiplied by the circumference in inches and divided by 12. Assuming the r.p.m. of the cutter to be 35, the cutting speed will be:

$$C = \frac{35 \times 6 \times 3.1416}{12} = 55.02 \text{ feet per minute.}$$

The value of $\frac{3.1416}{12}$ is 0.262, so that the last problem could be stated as follows:

$$C = 35 \times 6 \times 0.262 = 55.02 \text{ feet per minute.}$$

For an approximate solution it may be noted that 0.262 is not far from the fractional number $\frac{1}{4}$, and we can easily derive a simple formula:

$$C \frac{DN}{4}$$

Applying this formula to the preceding problem we have $\frac{6 \times 35}{4} = 52.5$ feet per minute, which is only slightly different from that given above.

The time-study man must first decide upon the proper speed and then obtain the number of revolutions required to produce this speed. This is readily done by solving the formula for N, thus,

$$N = \frac{4C}{D}$$

Referring to the example previously mentioned, in which the diameter of the work was 20 in., and assuming that we wish to use a cutting speed of 50 ft. per min., the application of the above formula will give $\frac{4 \times 50}{20} = 10$ revolutions per minute of the work.

Time-study men frequently use constants instead of cutting speeds. For instance, the cutting speed for cast iron is 50-60 ft. per min., and if this is multiplied by 4, we have 200-240. Then to obtain the r.p.m. for a piece of cast iron 20 in. in diameter, the time study man would simply write $\frac{200\text{-}240}{20} = 10\text{-}12$ revolutions per minute. Using the same system, the constant for cast steel would be 240, for malleable iron 280, and so forth.

After obtaining the required r.p.m. of the work to produce a given cutting speed, reference is made to the machine data sheet to determine the nearest speed, and this speed is used for the estimate. The machine speeds will not always give the exact cutting speed desired, and it is usually best to select one slightly less than that required, rather than one that is higher than needed. In other words, it is well to be slightly conservative in the estimate, particularly when large diameters are being turned or when cutters of large size are used.

When the composition and quality of a given piece of work are known and when the amount of finish allowance is in accordance with standard practice, the relation of feed to speed is fairly well defined, yet it is difficult to give hard and fast rules which apply equally well to all conditions. The depth of the cut and the amount of material to be removed are both important factors in setting a feed for a certain machining operation. It is apparent that there should be a direct relation between the cutting speed and the feed, and it is certain that a reduction in speed generally permits an increase in feed, although this is limited by the strength of the tool, the cutting angle, and the power of the machine. The kind of tool used is also a factor which must be considered. Stellite tools, for example, will run satisfactorily at greater speeds and with coarser feeds than high speed tools in the majority of cases.

Table of Cutting Speeds for Estimating Purposes

Material	Cutting Speed in Ft. per Min.
Cast iron	50–60
Cast steel	60
Malleable iron	70
Machine steel forgings (15 to 20 point carbon)	60–70
Machine steel bar stock	60–70
Tool steel forgings	35-40
Steel alloys containing nickel and chromium	30–50
Yellow brass	150–200
Composition brass	120–150
Bronzes—Manganese and phosphor bronzes usually require speeds approximating those for cast iron. Speed depends considerably on whether lubricant is used or not	30–80
Aluminum—Aluminum alloys usually cut freely with lubricant but the nature of the alloy and shape of the tools are important factors	150-300

It is difficult to give thoroughly reliable data on feeds but a few examples may be of interest. For estimating purposes, and always assuming that the normal finish allowance is provided, the following notes may be used as a basis in setting feeds. There are so many factors to be taken into consideration, however, that variations of from 20 to 30 per cent from the figures given are often correct under certain conditions.

Cast Iron

For roughing cuts on diameters up to 8 in. the feed may range from $\frac{1}{32}$ to $\frac{1}{16}$ in. Feeds for finishing cuts may be about the same, and the speeds increased 25 per cent or more, or the feeds may be doubled, using a slight increase of speed and broad-nosed tools. On diameters where the finish allowance is from $\frac{1}{4}$ to $\frac{3}{8}$ in., the feeds for roughing cuts may vary from $\frac{1}{16}$ to $\frac{1}{8}$ in., and for finishing cuts higher speeds can be used with finer feeds, or slower speeds with an increase of feed, if broad-nosed tools are used. On large work final finishing cuts are sometimes taken at cutting speeds 50 per cent higher than for roughing cuts, and with a feed of from $\frac{1}{4}$ to $\frac{3}{8}$ in. per revolution with very broad-nosed tools and when great accuracy is not required. These statements are based on actual practice and, while they cannot be considered as positive in their nature, they will be found to answer very well for a great proportion of cast-iron work.

Cast Steel

Roughing cut feeds on diameters up to 8 in. will vary from 0.020 to 0.040 in. Finishing feeds should be decreased by 25 to 50 per cent, while speeds can be correspondingly increased. For larger diameters, where the finish allowance is from $\frac{1}{4}$ to $\frac{1}{2}$ in., the feeds for roughing may vary from 0.040 to 0.060 in., and for finishing cuts on large diameters where considerable accuracy is required the feeds should be 50 per cent finer with speeds increased 25 per cent or more. Broad-nosed tools cannot be used to advantage for finishing steel castings, as they are inclined to tear the metal and leave it rough. The use of lubricant is

assumed when cutting steel castings, and the tools must be lipped and ground to suit the material.

Malleable Iron

Roughing cuts on diameters up to 8 in. can be made with feeds from $\frac{1}{32}$ to 0.040 in., and finishing feeds are about the same as for cast iron. The use of lubricant for malleable iron is recommended.

Machine Steel Forgings

The feeds will range from 0.020 to 0.040 in. for roughing cuts on diameters up to 8 in. For finishing the feeds should be decreased from 20 to 30 per cent and the speeds can usually be increased from 30 to 50 per cent. For larger diameters, when the finish allowance is considerably greater, the maximum feed can seldom be over $\frac{1}{16}$ in., and in many cases not more than $\frac{1}{32}$ in. is permissible. Finishing cuts on large diameters are generally about the same as for cast steel, always assuming that a plentiful supply of lubricant is provided.

Machine Steel Bar Stock

It is difficult to give feeds on this class of work because diameters are frequently reduced by taking a very deep cut with a fine feed, but when box tools or universal turning tools are used and when the stock reduction is not more than $\frac{1}{16}$ to $\frac{1}{4}$ in., a feed of from 0.020 to 0.040 in. can often be used.. In forming cuts and for greater stock reductions the feeds may vary from 0.002 to 0.015 in., depending upon the shape of the form to be cut and the method of applying the tools. Finishing cuts are seldom made with a coarse feed, but speeds are increased in many cases as much as 50 per cent.

Tool Steel Forgings

Roughing cuts on small diameters up to 6 or 8 in. with a depth of cut not exceeding $\frac{1}{4}$ in. can usually be machined with feeds from 0.012 to 0.020 in., and occasionally a feed of 0.030 in. can be used, if the forgings have been thoroughly pickled and annealed. For finishing cuts the feeds must be finer, although the speeds can usually be increased about 25 per cent. On large diameters feeds from $\frac{1}{32}$ to $\frac{1}{64}$ in. are possible in some cases, when the depth of the cut does not exceed $\frac{1}{8}$ in., but in estimating work of this kind it is seldom safe to exceed a feed of $\frac{1}{64}$ in. for roughing cuts. Finishing cuts for large diameters can be slightly coarser, if great accuracy is not required in the product and if the appearance of the work is not of primary importance. Otherwise fine feeds must be used and the tools "lipped" to curl the chip, in order to remove the metal easily and leave the surface smooth and clean. Lubricant must always be used on this kind of work and any boring tools for deep holes must be designed so that lubricant can be carried to the cutting edges.

Steel Alloys

Roughing cut feeds are usually about the same as for tool steel forgings. It is safe to follow the procedure noted in the preceding paragraph, unless it is possible to obtain a sample of the alloy on which tests can be made to determine the feeds and speeds possible.

Yellow Brass

For roughing cuts on work up to 8 in. in diameter and having a finish allowance of from $\frac{1}{16}$ to $\frac{1}{4}$ in., feeds from 0.020 to 0.040 in. can be safely used. It is not advisable to go much beyond these feeds as there is danger of tearing the metal, so that the finishing cuts will not remove the marks made in roughing. For finishing cuts tools should be ground with a "drag" and, when only a small amount is allowed for the finishing cuts, the feeds can be quite coarse, even with very high speeds. For roughing cuts on large diameters when the finish allowance does not exceed $\frac{1}{4}$ in., feeds as coarse as $\frac{1}{16}$, or even $\frac{1}{32}$ in., can be used in extreme cases. It is not advisable, however, to attempt to use too coarse feeds for the reason previously stated. In finishing large diameters the same rule applies as that mentioned for small diameters, that is, coarse feeds and high speeds, providing the tool is ground with a drag. Some operators prefer to use finer feeds in finishing, but this is not necessary if judgment is used in grinding tools.

Composition Brass

Roughing and finishing cuts are approximately the same as for yellow brass, although they should be slightly more conservative, as the composition is generally somewhat harder than ordinary brass.

Bronzes

For roughing work up to 8 in. in diameter where finish allowance do not exceed $\frac{1}{16}$ to $\frac{1}{32}$ in. on a side, feeds from 0.020 to 0.040 in. can generally be used, depending considerably on the nature of the alloy. Phosphor bronze and manganese bronze are hard in their composition and the feeds used must not be too great. In addition to this, the scale on bronze castings is extremely hard and has a strong abrasive action on the tools, so that they dull very rapidly. The speeds and feeds used in finishing can be considerably increased, but if good work is required, it is not advisable to use very coarse feeds and an increase of 25 per cent over the roughing cuts will usually be found satisfactory. For larger diameters when the finish allowances approach $\frac{1}{4}$ to $\frac{1}{16}$ in., the feeds for roughing can frequently be 0.030 to 0.060 in. In finishing large diameters slightly coarser feeds can be used than for the smaller sizes, but really coarse feeds cannot be applied to advantage if a good finish is desired.

Aluminum

The feeds for roughing this class of material vary greatly on account of the difference in the composition of the alloy. In general very coarse feeds can be used for both large and small diameters, providing the tool is suitably ground. The writer has seen aluminum castings 10 in. in diameter machined dry at a cutting speed of 300 ft. per min. and with a feed of $\frac{1}{8}$ in. per revolution. It would not be advisable, however, to use speeds and feeds of this kind for estimating, as the nature of the alloy might easily make a great difference. Feeds for the majority of roughing cuts on small diameters, when the finish allowance is approximately $\frac{1}{8}$ in., can vary from 0.040 to 0.080 in., and in extreme cases even more than this. Finishing cuts are possible at feeds from $\frac{1}{8}$ to $\frac{1}{4}$ in. per revolution, when broad-nosed tools are used. For large diameters an increase of about 25 per cent is permissible, both in roughing and finishing. It is advisable to be somewhat conservative in setting feeds for this class of work, but it will in general be found that the production time is much better than the estimated time, providing the operator uses judgment and tries to obtain the highest possible production.

In preparing these data the intention has been to give information which will be of value to men who are not thoroughly familiar with the possibilities of machining different classes of materials. For estimating purposes the feeds which have been given here will be found conservative, yet applicable to a large proportion of production work.

Splitting a Grinding Wheel—Discussion

By R. E. Marks

The method used by John J. O'Wril, illustrated on page 634, Vol. 60, of the *American Machinist*, is new to me. But isn't it an adaptation of the old "star" wheel we used to use in truing emery wheels in the old days when grinding hadn't yet crawled out of the cradle? The teeth need not be the same as a saw but can simply be a series of points which break away the abrasive and the bond when they strike the wheel.

Probably a hardened "saw" might last longer but I recall that for truing grindstones, a piece of soft iron or steel was much more effective than a piece of hardened steel. I have trued a grindstone many a time with the tang of a file and found it much better than the hardened end of the file. The best truing tool, however, was a piece of soft iron pipe rolled endwise across the face of the stone, using the rest as a support.

What Is Your Advice Worth?—Discussion

By F. Wright

I HAVE noted with interest the article "What Is Your Advice Worth" by Mr. Miller, and the later comments by Mr. Madden, pages 356 and 428 of *American Machinist*. Without a question this sort of thing touches a spot which is of vital interest to a lot of perfectly conscientious engineers. Also, if the truth were known, I wouldn't be at all surprised if there is a big interest in actual dollars and cents for the ultimate purchasers of engineering service.

The writer has been for some time connected with firms whose business was largely derived from the field of large installations of special equipment, which carried with it a vast amount of preliminary engineering development and design. I imagine that anyone in this line of work will agree that for every contract actually brought to the happy point where the customer's name appears on the dotted line there are a good many jobs which never get beyond the estimate stage. At the same time the work necessary to bring the job up to even this point is bound to cover a somewhat detailed analysis of all the components. Sometimes in the labor and material expended in this way will run into weeks of time and many dollars.

Knowing this condition to exist, which we might term the "percentage of closure," most firms actively bidding for work in this sort of field, or in fact even those whose natural functioning is likely to bring to them work of this uncertain nature, include in their regular charges or estimates, under the head of "engineering," "miscellaneous," or the like, an arbitrary item calculated to absorb the accumulated costs of gratuitous service. Or, not wishing for one reason or another to show up these items in their estimate or statement, they spread it over the entire job through a minute increase in unit values all along the line. In other words, it is a well understood fact that the cost is in the business and it is merely a question of the best way to get it out.

There is no question that the nearer we get throughout business to an honest basis of dealing, the better it will be for everybody. It would seem that a policy could be adapted which would make it an understood fact that any work done, which was not the logical portion of some larger job, that would carry its cost and retrieve its just return, would be charged for at a definite fair basis conceived on the actual value of the time consumed and material utilized.

A garage or jobbing machine shop usually has a flat hourly rate, which is recognized by those calling upon them for service, and most medical organizations have certain fixed scales of charges, which, subject of course to the individual practitioner's judgment on any case, are recognized as legitimate. Is it such a far cry to the achievement of a standard practice for the consulting engineering profession, which will end the present system, without a doubt unfair to everybody concerned.

Minor Diameter of Ring Thread Gages

By Arthur Wormwood

Several recent articles in the *American Machinist* have touched upon the subject of the minor diameter of ring thread gages. Mr. Fowler on page 573, Vol. 60, offers some very definite suggestions on this subject, stating that he has 60 per cent of a full thread in tapped nuts, and 85 per cent of a full thread in the ring thread gage. With these sizes, the ring gage covers 12½ per cent more of the single depth of the thread than is covered by the nut, giving what at first thought seems to be a margin of safety to protect against imperfect root diameters cut by worn tools. At the same time it is evident that the part of a male thread which is below the minimum minor diameter of the nut does not affect the fit of the male and female members; and parts, with a perfect form of thread, would mate as well whether the gage had 100 per cent or 50 per cent of a full thread.

Following this line of thought, it is my conviction that the minor diameter of a ring thread gage can safely be equal to the minimum minor diameter of the nut after it is tapped. The only reason for getting away from the 100 per cent or normal diameter is the fact that our ordinary tools do not cut a perfect form of thread; therefore we assume that increasing the minor diameter of our ring gage will allow more wear on our chasers without endangering assembling.

Right here is one of the danger elements of our present type of thread gages, for there is no certain way of telling whether the screw bears on the angle of the gage thread or, as sometimes happens, is really bearing on the root of the thread. The gage with 100 per cent full thread would of course be the first to bear on the deformed minor diameter when threading tools begin to wear, and the gage with the increased minor diameter would eventually bear, as wear on tools increased. But who, by the "feel method," can tell whether the thread gage is bearing at the root of the thread, or has the desired clearance?

Something more than our present type of gage is needed if we want to produce close fitting thread. Twelve years of experience with over 125 sizes of thread gages has shown that increasing the minor diameter of the ring gage does not in itself mean that a screw which seems to fit the gage will be of the correct pitch-diameter. Our present practice is to make the minor diameter of the gage 5 to 10 per cent smaller than the tap-drill size to allow for variation in drilling and for the burr raised by the tap. The major diameters of all male threads are turned at least 0.005 in. under standard diameters, the form of the thread being gaged by a single-point templet, so we know that with the correct lead, our screws and gages have angle bearing only.

If we must have a close fitting assembly, the limit gages suggested by the Screw Thread Commission would be best. In this type of gage the "go" ring gage is made to the maximum pitch diameter and the minimum minor diameter desired. The "not go" gage is made to the smallest pitch diameter and with a minor diameter that will give about 50 per cent of a full thread. Parts that pass these gages will meet all assembly requirements.

The subject of thread gages is of more importance than the average manufacturer seems to appreciate. We use screws, bolts and studs by the million and the time lost in assembling parts which do not fit but require selection makes up a greater total than many realize. Loosening under vibration frequently can be traced to improper fitting on the pitch diameter.

Manufacturing Silent Chain Parts

By C. J. Priebe

Steps in Manufacturing the Pins

Third article—The steel plant insures uniformity of material—Forming the pin stock—Carbonizing—Press work on the pins

BEFORE we can consider the actual manufacture of the parts that go in the chain itself, we must first note the processes through which the steel for the chain is put in the concern's own steel mill, located right at the plant of the Morse Chain Co., in Ithaca, N. Y. It was found necessary in order to obtain raw materials uniform in size, shape and quality, to maintain a cold rolling and cold drawing plant.

The raw material is brought in on the upper railroad siding and stored in a special building. An idea of the amount of stock carried and the type of raw material employed can be obtained by reference to Fig. 13. The material is all in the form of coils. The strip stock is for use in making links, and is a medium-carbon molybdenum steel. The round rod is for the pins and is a low-carbon nickel steel. The material is worked down so as to be considerably smaller in section, and exact to size before it is sent to the machine shop.

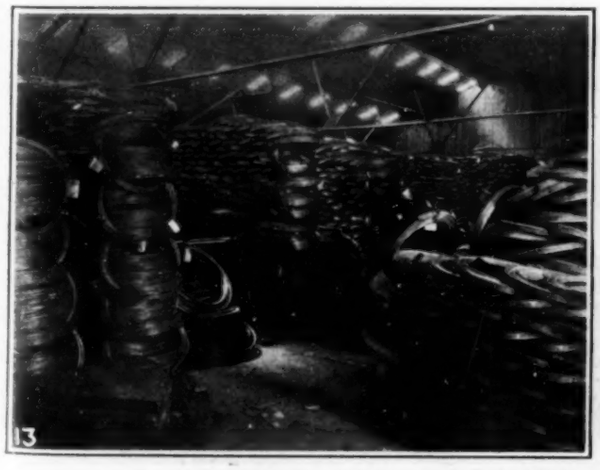
The inside of the rolling and drawing mill appears as shown in Fig. 14, which gives some idea of the size of the plant required. All stock is first annealed, then cleaned in acid, washed and dried in a special oven. Considering first the strip stock from which the links and washers are made, the process of finishing is comparatively simple. The coils, which weigh about 100 lb., are put through three successive rolls to bring the stock to the required size. A battery of the rolls can be seen in Fig. 15. The stock, which has been elongated about 40 per cent, is now ready for the presses.

As has already been explained, pins employed in the Morse chain are not circular in sections. At each joint there are two pins, one known as the seat pin and the other the rocker pin, each pin having a characteristic section. Consequently, it is necessary to form the round bar stock into the two accurately shaped sections required for the different types of pins. The process chart shown in Fig. 16 illustrates the steps through which the material is taken to give the finished pin stock. Both the major operations that are numbered and the minor ones such as coating can all be noted there.

Drawing Operations

The hot-rolled stock is first passed through a drawing die to give it a uniform circular section. It is then rolled to roughly shape it by passing it between grooved rolls as shown in Fig. 17. The rolling merely gives an approximate shape, and the finishing must be done by drawing. Several drawing passes are required, depending upon the reduction in area which the steel will endure. The work is done on drawing benches such as shown in Fig. 18, where a number of coils are being drawn at the same time. The drawing operation is similar to that ordinarily employed. Before each draw the stock is annealed, cleaned, dried and coated with lime. In order that the stock may be kept at a temperature of about 80 deg. Fahr. before being drawn, a warming box is used in cold weather. The unusual feature of this equipment is that the box is electrically heated.

When a coil of rod for the pins has been completed, it is found that the original 300 ft. of hot-rolled rod has increased in length to about 800 or 900 ft. It is necessary to hold the size and the shape of the pins



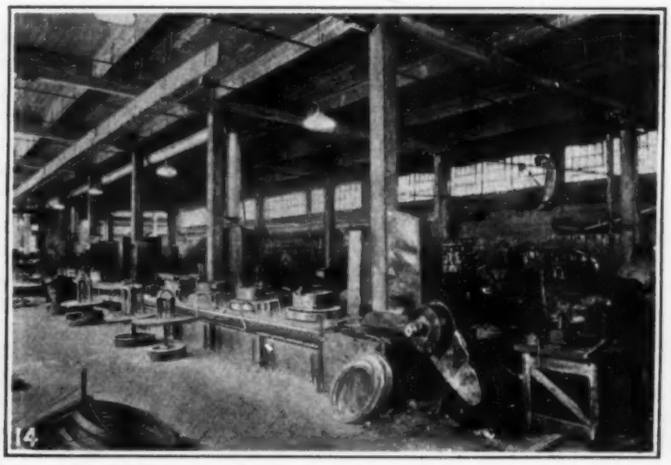


Fig. 13—Storage of hot-rolled stock. Fig. 14—Rolling and drawing mill

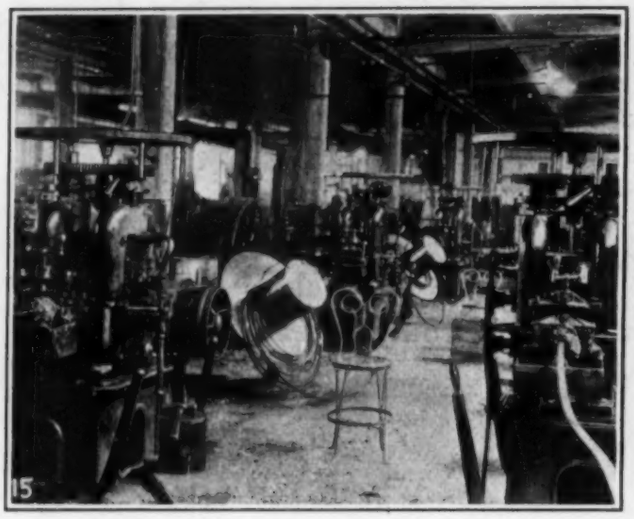


Fig. 15—Battery of cold rolls for link stock.

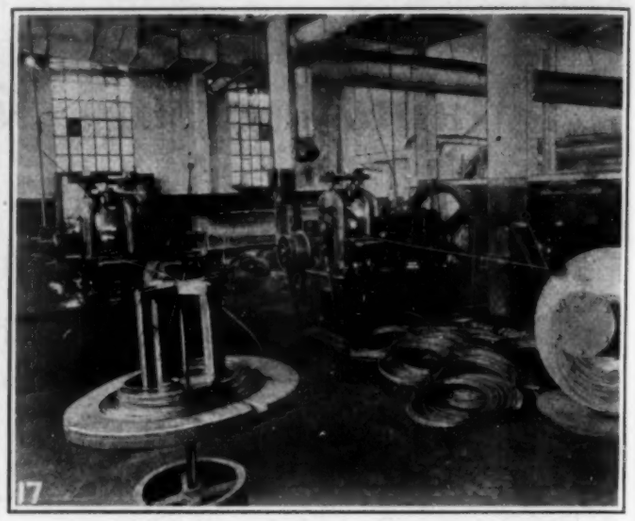


Fig. 17—Shape rolling pin stock between grooved rolls

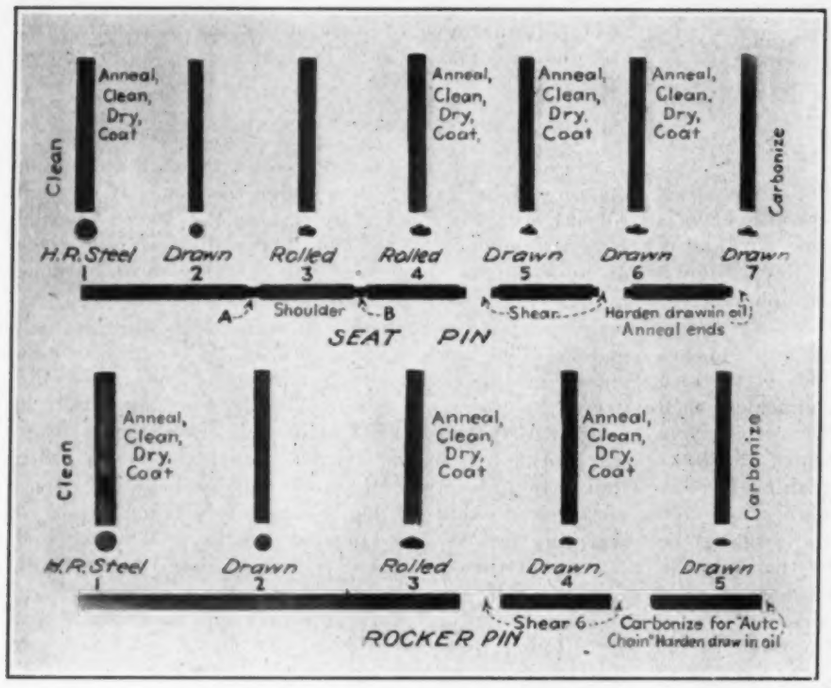


Fig. 16—Steps in making the pins

within 0.0005 in. in order to obtain the exact pitch in the assembled chain. Each operator is responsible for the size of the stock that he turns out, and he takes care of his own drawing dies.

The stock for the links is sent to the press room in coiled form. The pins, however, must be straight, so the straightening bench illustrated in Fig. 19 comes into use. The wire or rod from the coils is straightened and then cut into lengths of 15 feet.

Before any machining operations are performed on the pins, the stock is carbonized. A view in the carbonizing room can be obtained from Fig. 20. This building is also of concrete construction, well lighted and ventilated, and the furnaces are so arranged and covered as to prevent heat loss as much as possible. There are four carbonizing furnaces and two annealing furnaces, all of the company's own design and burning producer gas. In order to care for emer-

Fig. 18—Cold drawing pin stock.

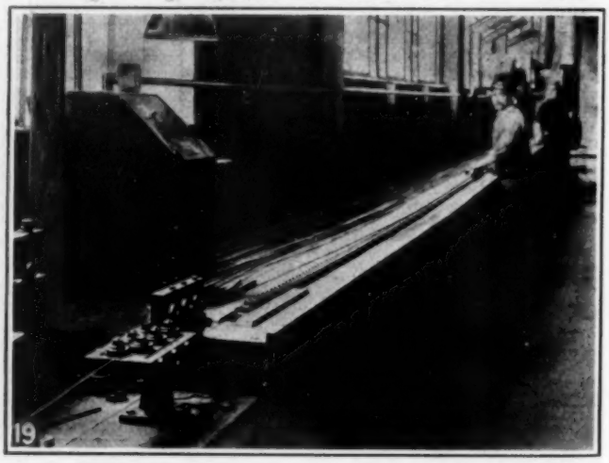
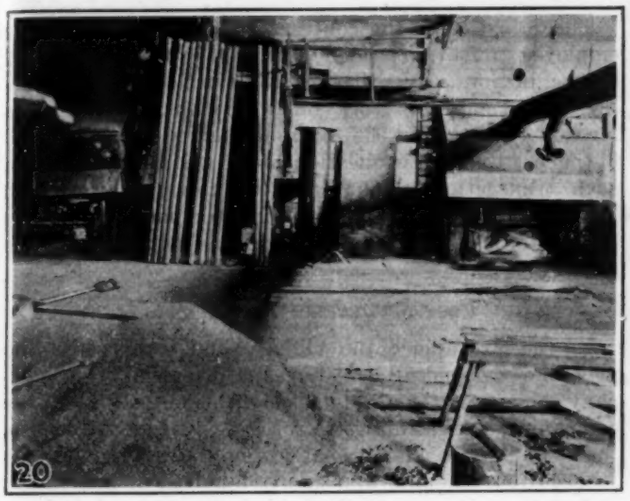


Fig. 19—Straightening pin stock



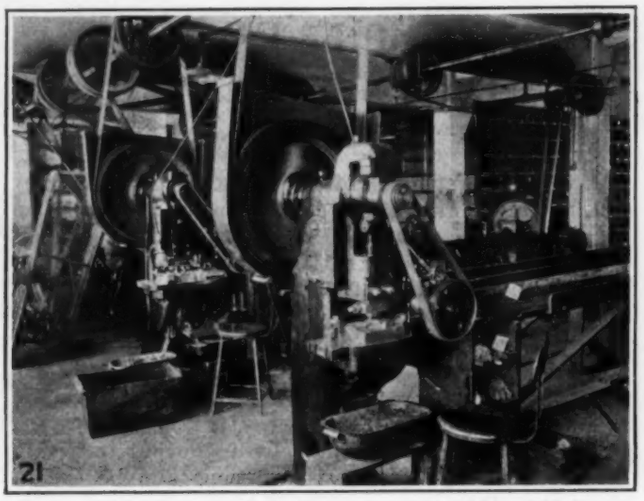


Fig. 20—Equipment for carbonizing pin stock. Fig. 21—Presses for shearing pins

gencies such as the shortage of coal, the furnaces are equipped for burning oil.

The pin stock is brought to the carbonizing room on trucks, and is then placed inside 4-in. iron pipes and packed with a carbonizing material. In loading, the pipe is ordinarily laid on the horses shown in the foreground at the right. When the stock is put in the pipe, spreaders such as seen on the floor are placed

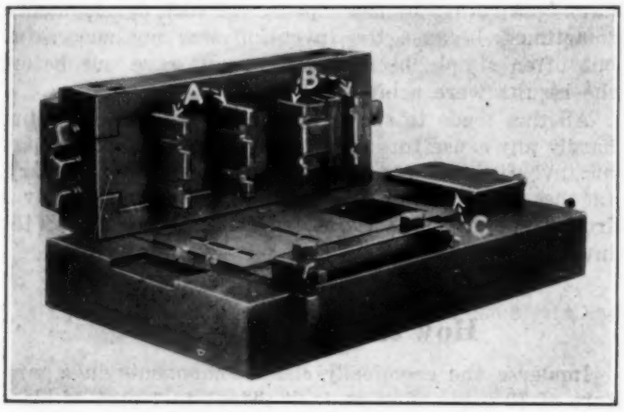


Fig. 22—Press tools for seat pin

between the rods, so that no two rods can touch each other. The carbonizing material, ground bone, is packed around the rods and the pipe is sealed.

The pipes shown standing vertically have just been filled and are ready to put in the furnace. In the furnace at the left there can be seen pipes which have been heated and are ready for removal, while the pipes shown lying on the floor are ready to unload. Before unloading, the pipes are allowed to lie and cool slowly for 12 hr., so that the stock is properly annealed. The rods must then be straightened. An exception to this procedure is the rod for the rocker pins of "auto chain," which are cut to length before carbonizing. In this way they can be more easily handled and need not be straightened after carbonizing.

In this same room the wire is also annealed as required before drawing, a truckload of coils being shown at the right.

After being carbonized the pin stock is brought to the press room. Here there are eight V.&O. No. 21 presses equipped with sub-presses made in the plant for cutting the pins to the proper length. It has been noted that there are two kinds of pins, the rocker and the seat. Each pin requires different treatment in cutting off. The seat pin is the one which projects beyond the links, carries the washers and is riveted over. The rocker pin, however, is merely the length of the combined thicknesses of the links and its ends are perfectly square.

Cutting the rocker pins requires no particular special machinery, although naturally dies have been developed for the job. The press shown in the foreground in Fig. 21 is so equipped. The rods are laid on the long table at the right and are started by hand two at a time in the self-feeding attachment that is to be seen on the front of the machine. After the rods are in place, they are fed automatically by the power-driven roller.

Four Pins Cut at One Stroke

At each down-stroke of the press two rocker pins are cut off from each bar, making four completed pins such as shown in Fig. 16. There is no waste of stock except the slight amount at the ends of the rods. The presses run at 120 r.p.m. and operate automatically while the treadle is depressed; the parts are delivered at the rate of about 500 per minute.

Before the seat pins are sheared, a shoulder is punched on the side at the point where the stock is to be cut. Otherwise the operation is very similar to that just shown. The press at the left in Fig. 21 is fitted up for handling the seat pins. Two rods are fed at a time by the automatic feeding device.

The press carries two shouldering punches which cut at one stroke the shoulders as shown at *A* and *B* on the operation chart in Fig. 16. These punches appear at *A* in Fig. 22, where the punch assembly can be seen lying on its side on the die block. At the next stroke the stock is fed further across the die and against the stop *C* so that the shouldering punches operate at a new position on it, and the shouldered portion of the stock is brought underneath the shearing punches *B*. These latter punches cut off two pins from each rod, much in the same manner as was done with the rocker pins just described. In this way four pins are completed at each stroke, and the production averages about 500 per minute. It should be noted that there is no waste in the length of the stock, aside from a small portion at each end of the rod.

Rights of the Employee On His Inventions

By J. P. Nikonow

A LARGE proportion of the patents issued weekly by the U. S. Patent Office is taken out by manufacturing companies on inventions made by their employees. According to the U. S. laws the patent must be issued in the name of the inventor, who may assign his patent to the company for a "valuable" consideration. In order to make this assignment formally legal the company pays the inventor one dollar, gets his receipt, and then proceeds with the patent application at its own expense.

The employee has nothing else to do but to assign his invention on the above conditions and he cannot claim any other compensation if he was engaged to do the development work. The same is true if he made his invention while using the company's facilities. He cannot claim any rights on the invention.

Quite often, however, the situation is not quite so clear. The inventor may have been working during his spare time; he may have used his own information acquired previous to his present engagement; the invention may be of a nature different from his line of work. In such case he may retain ownership of the invention and may even sell it to his company.

Sometimes in such cases it is difficult to determine the exact status of the invention. The company, upon learning of the invention, may simply request its assignment; or, in order to encourage the inventor, it may allow him a certain royalty on the patented device. Or the inventor himself may decide to surrender his invention, considering that he would be unable to exploit it independently, and he may be indirectly benefited by the company for his loyalty. A substantial increase in salary may be more valuable than an uncertain royalty.

Some companies have adopted a very strict policy in regard to inventions and require every employee to sign an agreement whereby he becomes placed under obligation to surrender every invention, no matter how made and in what line, so long as he is in their employ. If the employee makes a valuable invention and does not want to give it to the company, he has no course left but to resign and then proceed with the patent application. It happens very seldom, however, that an employee decides to give up a paying position in favor of an uncertain and speculative profit from his invention.

Assignment of Inventions

Sometimes, when a man is employed to work on some valuable inventions, the company asks him to sign a special agreement according to which the inventor must assign to the company all his inventions in a certain line, even if they are made within one or two years after he has left the company's employ. Such agreements are usually upheld by the courts, and only recently the National Cash Register Co. was awarded damages in a case against a competitor who attempted to use certain inventions of a former employee of the National Cash Register Co., the patents on these inventions having been applied for within one year after the employee left the former company with which he had such special contract.

The injustice of the contract according to which the employee must surrender ALL his inventions is, of course, obvious. But there is no injustice in surrendering inventions for work on which the inventor has already been paid in the form of a salary.

Indeed, there is a question as to who is the loser in such transactions. The inventor gains a dollar and improves his standing with the company, but loses his rights on the invention. But just what is in these rights?

Cost of Developing Patents

In the first place the rights simply represent the privilege of spending money on the invention. The company pays for the patent application. With large companies, maintaining a force of patent attorneys, the cost of a single patent application, with its prosecution, amounts to over five hundred dollars. Then will follow the cost of making working drawings, experimental models and tests. Here the cost will easily run into thousands and tens of thousands of dollars.

But, of course, a patent means monopoly. As a matter of fact, however, a very small percentage of patents give any kind of monopoly. The majority of them have only a speculative value and may even never be reduced to practice or put into use.

The high cost of development causes a high rate of mortality among even good inventions. Companies have been ruined by the expenses of such developments, sometimes, because the invention was not successful, but often simply because the money gave out before the results were achieved.

All this tends to show that an average inventor has hardly any cause for complaint when the company takes his invention and pays him a more or less liberal salary. In that way he is sure of his income and is saved from large expenses connected with promotion of the inventions.

How to Nitre-Blue Steel

Immerse the chemically clean components in a mixture of 10 parts of nitre (salt petre) to 1 part of black oxide of manganese (MnO_2), by weight, heated to 800-850 deg. F. The mixture should be contained in a cast-iron pot, heated by any suitable fuel.

Best results are obtained when the components are contained in a wire basket. They are allowed to remain in the nitre for from 5 to 10 min., the longer the time the darker the blue.

Upon withdrawing the components, quench them in water at a temperature of from 125-150 deg. F. and when dry cover them with raw linseed oil and allow them to drain.

Springs are generally drawn back at from 450 to 600 deg. F., depending upon the analysis of the steel. Higher carbon content requires higher temperature. Even the 600 deg. tempering temperature is too low for the nitre-bluing process and another method must be used. To get good results have the springs clean and then heat them on the surface of a layer of sand, contained in a pan, either in the furnace or by a fire applied underneath the pan, until the color desired has been obtained. The parts should be turned occasionally during the heating, and after the coloring has been completed, they should be spread out to cool.

Economic Analysis of Machine Shop Operation

By A. L. De Leeuw

The ideal scheme, its advantages and disadvantages—Is it economically sound?—Interest on investment and on savings must not be left out of consideration

THE duration of the longest operation is now established as 100 sec. The ideal scheme, therefore, is the one which provides for the performance of all of the operations in this length of time.

Before making a study of the conditions which may prevent us from reaching this ideal, the advantages and disadvantages of such a scheme should be considered in a general way; and the engineer or executive considering such a scheme should keep in mind that while a single disadvantage may, at times, neutralize all of the advantages, on the other hand, disadvantages, like troubles, are things which either exist in our minds only or else can be overcome by them.

The advantages are:

- Minimum labor cost
- Minimum floor space
- Minimum stock and parts in process
- Minimum handling
- Minimum inspection
- Minimum losses on account of faulty operations
- Maximum accuracy
- Maximum assurance of proper relations of the various elements.

The main disadvantages are:

- The fact that special machinery is required
- The cost of equipment
- The low value of equipment in case of disposal
- The uncertainty of the life of the piece
- The fact that breakage of one tool stops all production
- The fact that stand-by machinery is required
- The fact that the machinery requires attention of a high order, and that the factor f is necessarily low.

The connecting rod forming the subject of this analysis lends itself well to the combining of practically all operations—that is, from a purely technical standpoint. A machine can be readily imagined which would perform all the operations simultaneously. This fact reduces to two the three items which as a rule should be considered: namely,

- The technical possibility
- The technical practicability
- The economical practicability.

When it is stated that all operations can be done simultaneously, it is not meant that all the tools shall work at the same time on one piece, but that a station type of machine could be constructed which would permit of performing all, or almost all, of the operations with one chucking. Such machines are usually built with a turret. A certain number of operations are performed at every position of the turret but one—the loading and unloading position. As a rule, the design of such a machine offers fewer difficulties than that of a standard commercial tool, first, because the machine does not need to take in a wide range of shapes and sizes but needs adjustments only for wear of spindles, slides, and tool, and secondly, because it does not have to compete on price.

On the other hand, the building of such a machine requires the highest possible accuracy if the piece of work shall be reasonably accurate, and as this latter point is not always thoroughly understood, an example will be given here to show why this great accuracy is essential in such a turret type of machine.

The turret must index with great precision, and the chucks or work-holding devices in general must all be located in the same relation to the center of the turret and to the index slot.

As an illustration, it will be assumed that 4 holes must be drilled in a piece of work and that this is done by 4 spindles located opposite the 4 work stations of the turret, the total number of stations being 5. Of course, such an arrangement would not be chosen for the simple task of drilling 4 holes, but this assumption simplifies the problem and makes it easier to visualize. The 5 stations will be called A, B, C, D, and E. Each one of the index notches varies somewhat from its ideal position, in other words, the notches are not exactly 72 deg. apart, but some intervals are larger and some smaller. The errors will be indicated by a_1, b_1, c_1, d_1, and e_1. The chucks are also more or less wrongly located in relation to the index notches and the centers. These errors will be called.

$$\begin{matrix} a_2 & b_2 & c_2 & d_2 \text{ and } & e_2 \\ a_3 & b_3 & c_3 & d_3 & e_3 \end{matrix}$$

in which the upper index denotes the amount of error relative to the index notch and the lower one that relative to the center. The spindles also have two errors which are indicated here by

$$\begin{matrix} b_4 & c_4 & d_4 \text{ and } & e_4 \\ b_5 & c_5 & d_5 & e_5 \end{matrix}$$

The holes to be made are indicated by P, Q, R, and S.

The first piece, chucked at A, will have its first hole drilled at B, its second at C, etc. The second piece,

Concluded from page 846, Vol. 60.

which will be chucked at E, will have its first hole drilled at A, the second at B, etc. The third piece will be chucked at D and will have its first hole drilled at E, the second at A, etc. Each hole will be in error the algebraic sum of the errors of index notch, chuck position, and spindle position, so that the errors for the four holes of the first piece can be expressed thus

$$b_1+b_2+b_4 \quad c_1+c_2+c_4 \quad d_1+d_2+d_4 \text{ and } e_1+e_2+e_4$$
$$b_2+b_3 \qquad c_3+c_4 \qquad d_3+d_4 \qquad e_3+e_4$$

The second piece will have the following errors:

$$c_1+c_2+c_4 \quad d_1+d_2+d_4 \quad e_1+e_2+e_4 \text{ and } a_1+a_2+a_4$$
$$c_2+c_3 \qquad d_3+d_4 \qquad e_3+e_4 \qquad a_3+a_4 \text{ etc.}$$

This shows that not only are the errors of the machines duplicated in the piece, but that the relative position of the holes does not remain constant. The author has found it necessary to employ special methods in the design and construction of such machines to secure a degree of accuracy of a higher order than that required for ordinary machine tools. It is this need for unusual accuracy which causes machines of this kind to be so expensive. However, designers have often made the mistake of ignoring the special requirements of individual cases. In the present instance no great accuracy is required anywhere, and even those dimensions which do not permit of a large variation are between points which can be located in one station, so that there is no fear of undue accumulation of errors.

The piece would be clamped on the circumference of the turret. In the first position the two main holes would be drilled, both sides of the large hole would be chamfered, and the tops and bottoms of the bolt-hole lugs would be straddle milled. In the second position the bolt holes and the binder-screw hole would be drilled and the bolt holes chamfered. In the third position all oil holes would be drilled and the binder-screw hole tapped. The fourth position would take care of the reaming of the two main holes, and the fifth position of the sawing for the binder screw and the cap, and straddle milling the splasher.

It should be emphasized here that this is not the only possible arrangement but merely one which is feasible and which is given for the sake of focusing on a definite method.

The next step is to consider this arragnement from the standpoint of practicability. It is seen at once that to separate the cap from the body in this machine materially reduces the chances for a solid support of the head against the drill. This appears to be of enough importance to warrant dropping this operation.

Countersinking the back of the head also seems to be doubtful. However, a closer examination shows that this operation can be included without danger of affecting the success of the other operations.

Economic Soundness of Method Proposed

The main question remains to be answered: namely, whether such a method would be economically sound. Before going deeply into this matter it should be remarked that a machine such as was imagined would be capable of a certain amount of adjustment so that changes in the dimensions and even in the distances of the holes would not make it useless. The construction of the connecting rod would have to be changed in its essentials before the machine would become obsolete. This consideration affects the estimate of the useful life of the machine.

Assuming that a first machine costs $25,000, that a second or stand-by machine costs $15,000, and that the useful life of these machines is five years, the following is found:

Cost of machines	$40,000
5 years' interest	12,000
Total	$52,000
Cost per year	$10,400

Estimating that there are 2,400 working hours in a year, the production will be $2,400 \times 3,600/100 = 86,400$ pieces, because it takes 100 sec. per operation. This shows that the machine cost per piece will be a little over 12 cents.

If the quantity to be produced is sufficiently large, this machine cost per piece may be reduced in various ways. For instance, double sets of tools and chucks may be provided so that the operator chucks two pieces instead of one; or that part of the plant may be run on the two- or three-shift plan, or else the longest operation, the drilling of the main hole, may be split in half.

The first method is not desirable, partly because it makes the machine too large and complicated, and partly because some of the duplicate tools will be in each other's way. The second method cannot be seriously considered except when other parts of the plant must be run in the same way. The third plan is entirely practical, adds only one station, so that the size of the machine is not much increased, and actually simplifies matters by distributing the tools more evenly. If this third method is followed the machine cost per piece becomes 6 cents.

It may be noticed that the machine was supposed to work all the time, no allowance having been made for tool setting and adjustment. This is proper where there is a stand-by machine, as one machine can be in production while the other is being made ready. A small percentage may have to be deducted for absence of the operator, and this may be met by considering the machine cost to be 6½ cents.

Single operations performed according to modern methods, using multiple-spindle drill presses and turntables—in short, methods which compare very well with those used in the most productive shops—bring the total time for these operations up to 333 sec. per rod. The single machine therefore saves 233 sec. per piece or not quite 4 min. Estimating the labor cost at 75 cents per hour, the saving in labor cost would be 5 cents per piece, which is less than the machine cost. Against this the machine cost for the single operations must be figured.

By splitting the drilling operation and thus reducing the time per piece to 50 sec. the saving per piece becomes practically 6 cents, so that even in this case no profit is shown.

If the production requires a piece to be finished every 50 sec. and it takes 333 sec. to finish one by single operations, then there must be more than one set of machines in use; not all the machines, however, would have to be duplicated. This brings the machine cost for the single operations somewhat higher, but not high enough to justify the building of special machinery with its chance of failure and its almost certain period of development.

If the quantities required are larger, and especially if the life of the piece is certain to be a great many years, another story would be told.

Notwithstanding the fact that the actual machinery

cost may not be reduced, there are cases where such special machinery is desirable for the reasons given heretofore and also because present conditions make any method desirable which substitutes machines for men.

That there is little or no final economy in a complete combination of all operations does not prove that there can be no economy in the combination of some of them. In the case here considered it would seem, at a first glance, that there should be some advantage in the simultaneous drilling (and also reaming, if reaming is done at all) of the two main holes. In fact, the comparison made above was between the complete machine and single operations, some of which had already been combined.

Single Operations and the Turret Machine

If every operation had been done singly, the final result would have been much more in favor of the turret machine. However, before deciding that such a machine should be built, it would have been necessary to consider various partial combinations and the final result would have been the same.

An analysis of this kind may appear to be a slow and tedious bit of work, but when a factory must give up a considerable part of its floor space and a number of machines and tools for the manufacture of a single piece, and in addition provide a number of men, the management is not justified in selecting a mode of procedure unless it has tested out, at least on paper, all possible combinations. A few days are well spent on such a task. That various factories employ radically different methods to obtain the same result is prima facie, if not conclusive, evidence that such an analysis is not always made and that so-called "judgment," which might more properly be called guesswork, has taken its place.

In estimating the cost of the special machine first cost and interest were both figured, and this is proper, because if the machine had not been built, the fund used for the machine would have been bearing interest through all the years of the life of the piece. On the other hand if we consider the savings made by the use of such a machine as capital returned to the business, this capital also would be bearing interest.

Actual Savings Figures

It was found in an earlier paragraph that the cost per year of the special machines was $10,400, and that the machine cost per piece was 6 cents. It was also found that the saving in labor cost per piece was 6 cents, so that the saving per year was also $10,400. This profit is made annually for five years, so that the first year's saving bears interest for 4 years, the second year's saving for 3 years, etc.—altogether the equivalent of 10 years' interest on one year's saving. Assuming, as before, an interest rate of 6 per cent, this would amount to $6,240.

This item of interest on the savings is often overlooked. In this case the item is not large enough to change the conclusion reached before, but where the life of the piece is long the item becomes of considerable importance.

As an example, a case will be assumed where it is estimated that special machinery costing $1,000 will produce savings of $2,000 per year; and where the life of the piece is estimated to be 10 years. Without considering the interest on the savings, we would find the following conditions:

First cost	$10,000
10 years' interest at 6 per cent	6,000
Total cost at end of 10 years	$16,000
Saving per year	$2,000
Total savings at end of 10 years	$20,000
Profit	$4,000

This is too small a profit to justify the purchase of the special machine. However, the balance sheet looks different when the interest on savings also is considered, as it should be.

The total interest on the savings is the interest for 1 year plus that for 2 years, etc., up to the interest for 9 years. This total equals the interest on $2,000 for 45 years and amounts to $5,400, so that the total profit is not $4,000 but $9,400, and this may well be enough to justify the purchase of special equipment.

Senator, Spare Our Inch

By Merle Smith

Some time ago when we sent in our subscription to the *American Machinist* we were asked to send in ideas at any time. We've held our horses so far and refrained from butting into the editorial sanctum, but two things have recently come up which got us hot under the collar. And the worst one is that recent jab at our measuring system in general and the "mike" in particular, and in that connection we'd like to shake hands with R. E. Marks for his letter on page 578, Vol. 60.

Wouldn't we have a swell time trying to use a one inch mike if we changed the inch to 0.1 ft., as Senator King proposes. The senator evidently thinks we measure work by the *foot*, if he thinks about it at all. But we use the *inch* and divide it into hundredths and thousandths and have no trouble.

We have a few instances where metric threads are used on foreign cars. But we always re-tap with an S.A.E. thread where possible instead of making a metric tap or sending for one. We discourage the use of metric sizes and will not carry them in stock.

A few people seem to be having a spasm on beauty in machine design. We are inclined to believe that this may be a big point with some young shop owners in cow towns and farmers' burgs. The cowboy goes to one of two extremes—either all the fancy gingerbread work he can get on saddle, bridle, spurs, etc. or absolutely plain. We, of the metal trades have graduated from Gothic or Corinthian columns on drill presses and grape vines on lathe legs. We like 'em plain and substantial. Of course, there are different ideas of beauty, but our ideas run to plain symmetrical lines and plenty of metal. We haven't a large shop nor all the tools we would like to see decorating its interior scenery. But we picked 'em for utility and they are good looking enough so that a machinist won't mistake them for chunks of cast iron and use a hammer on them.

Our town has less than 400 votes but our shop has 4 lathes, 2 shapers and 2 drill presses and keeps more than 20 motor trucks and 200 passenger cars going.

We're out in the country, but we try to keep up to the minute on new things in the machine game. And when anyone, senator or otherwise, tries to monkey with our standards of measurement, he's about as popular with us as is a skunk at a lawn party.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

An Efficient Fixture for Internal Grinding

By Jack Williams

The illustrations show a simple and effective fixture used in connection with internal grinding operations on the spindles of the Cone automatic, that is in every day service at the shops of the Cone Automatic Machine Co. at Windsor, Vermont. Though the spindles to be ground vary in diameter and length in accordance with

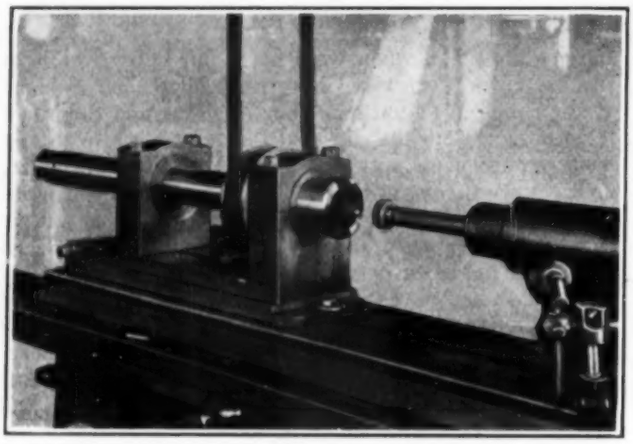


Fig. 1—Grinding the parallel bore

the size of the machine to which they belong, this fixture serves for all except the larger sizes; for which a similar fixture with back-geared drive is available.

The base of the fixture clamps to the table of a Brown & Sharpe universal grinding machine, though the swivelling feature of the latter is not employed. Instead, the base of the fixture consists of two parts, the upper one of which swings about a fixed stud midway of its length. Two adjustable stop-screws at the rear end of the base, limit the amount of swing; one to stop the fixture with the axis of the spindle parallel to the line of travel of the machine table, and the opposite screw to locate it in correct angular position to grind the taper seat in the nose of the spindle.

The spindle is driven by belt from an overhead drum in the usual manner and runs upon its own journals in bronze bearings. A set of these bearings is provided for each size of spindle to be ground, all of them of the same outside diameter to fit the fixture. To change from one size of spindle to another, all that is necessary is to substitute the proper sized bearings and place a bushing in the driving pulley to correspond with the size of the spindle.

Starting a lot of spindles by grinding the parallel bore of the first one, the operator then loosens the clamping nut, swivels the base of the fixture as far as the stop screw will allow, tightens the nut and grinds

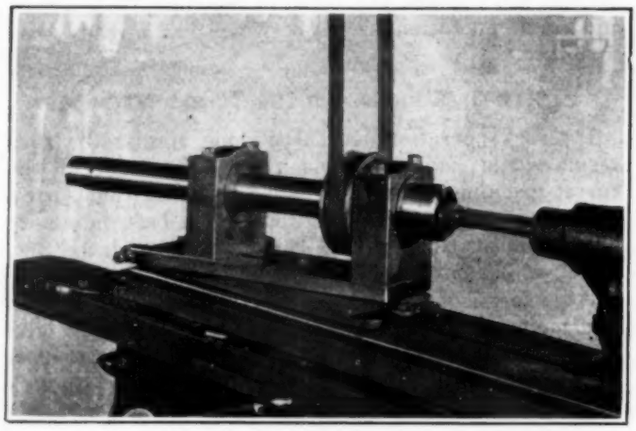


Fig. 2—Grinding the angular seat

the angular seat. Substituting the next spindle the angular seat is ground first, after which the base is swung in the opposite direction until it meets its stop, when it is in position to grind the parallel bore. Thus but one movement of the fixture is required to grind each spindle.

A Serviceable Tote-Box

By Amos Ferber

There are all kinds of tote-boxes in machine shops and they are generally in a more or less dilapidated condition, due rather to the system (or lack of system) in handling them, than to any legitimate wear and tear.

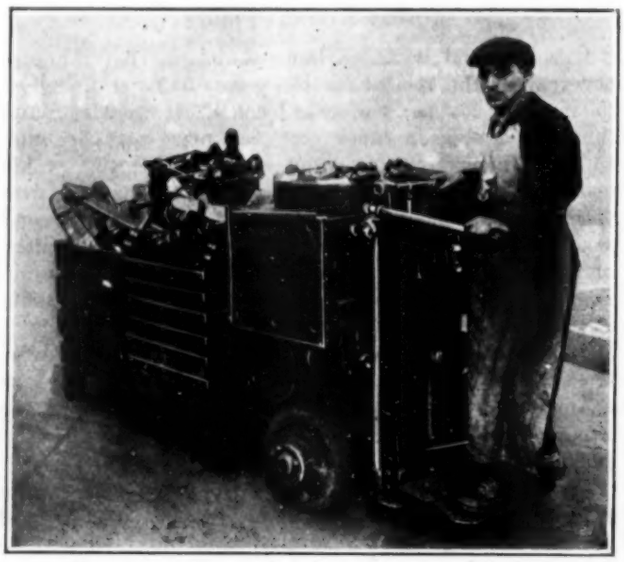


Fig. 1—Two tote-boxes on electric transveyor

They are usually dragged about the floor with hooks, thrown carelessly on and off the shop trucks, and if a man happens to be carrying one and wants to set it down he gives it a heave and gets out from under.

The boxes shown in the accompanying illustrations (the same boxes in both) are designed with a purpose. They are intentionally made too big to be dragged or carried about the shop other than on a proper truck; they are deep enough to obviate the necessity for stacking; and they are light in proportion to their strength. Four stout corner pieces are joined with side and end strips, bound with box strapping, and the crates thus formed are fitted with bottoms.

The bottoms are several inches above the floor, and the lower side strips are at a different height than those at the ends. The distance lengthwise between the corner posts, which form legs for the box to stand on, is calculated to admit the electric transveyor as shown in Fig. 1, which runs under and picks up two boxes at a time. The hand transveyor, Fig. 2, goes under the box lengthwise, the width of the box and the height from the floor of the lower end strips being calculated to accommodate it.

Fig. 2—Picking up a single box with the hand transveyor

An Elevated "Pit"

BY MILTON WRIGHT

A pit, in a shop where heavy machinery is built, is both a convenience and a nuisance. Where the nature of the machinery is such as to necessitate getting underneath for the purpose of adjustment, or during construction, the pit is indispensable. On the other hand it makes a convenient catch-all for odds and ends about a shop, accumulates oil and grease, pieces of timber, loose papers and other material, and, when not covered by machinery, too often becomes a trap for unwary feet.

The structure shown in the accompanying illustrations has all the advantages of a pit, and, when conditions are favorable to its use, none of the disadvantages. To make it a practical proposition, however, two things are necessary: The machinery under construction must be of a nature to be easily handled by a crane, and there must be a crane to handle it. Both of these conditions are fulfilled in the Bullard shops.

The machine shown in Fig. 1 was placed on the structure at the request of the photographer, and from the time the first move was made to lift it from the floor of the shipping department, sixty feet away, to the moment of making the exposure the elapsed time was not more than three minutes. Fig. 2 shows the machine in transit.

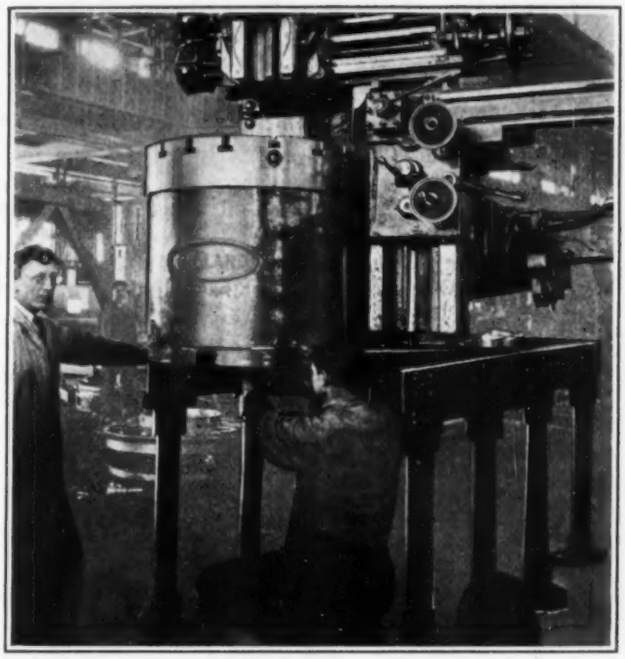


Fig. 1—A finished machine over the "pit"

The frame is made of standard structural shapes and supporting columns of extra heavy wrought-iron pipe with specially fitted flanges, The whole framework is firmly bolted together and is anchored to the floor so that it is perfectly stable and safe. A machine resting upon it is fully as accessible from below as it would be over a pit, and the workman can go about his job with a degree of freedom and comfort not usually attainable in the average pit.

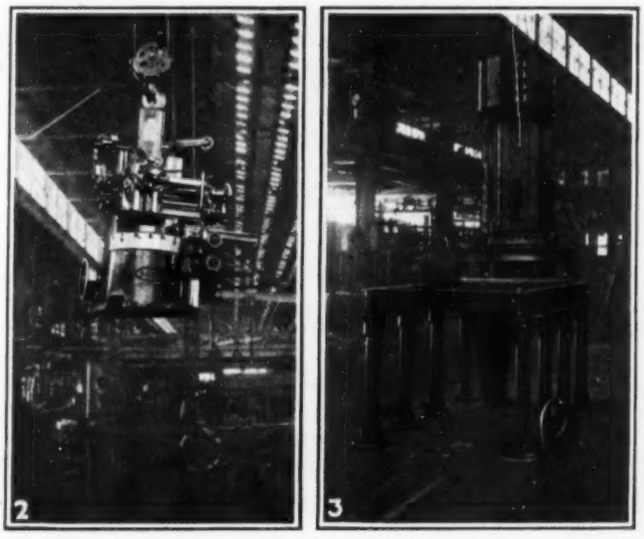


Fig. 2—The machine in transit. Fig. 3—A "regular" job

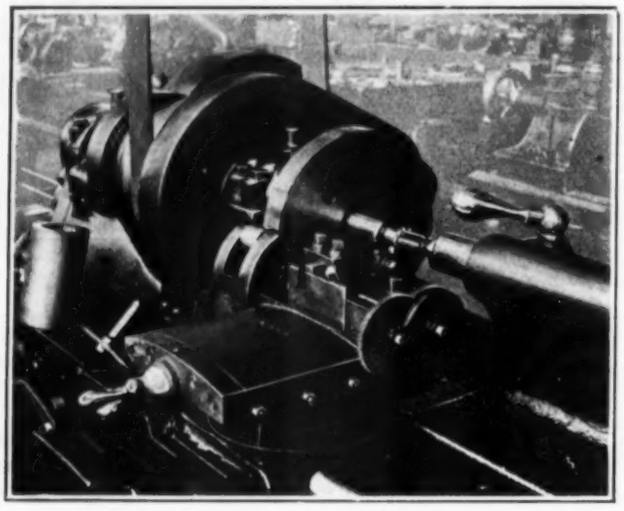
While the machine shown in Figs. 1 and 2 was placed on the structure for the sole purpose of photographing, the one shown in Fig. 3 was placed there in the ordinary course of work and without prearrangement.

Device for Backing-Off Thread-Milling Hobs

BY E. AMOS

The illustration shows a device for backing-off thread-milling hobs that is regularly used in the toolroom of the National Acme shops at Windsor, Vt., instead of the standard backing-off attachment usually furnished with toolroom lathes.

The cross-feed screw is removed from the lathe and a bracket bolted to the side of the base of the compound rest to carry a cam roll. A weighted cord, passing over a sheave at the rear of the carriage, serves to hold the roll against the periphery of the cam at all



Device for backing-off hobs

times. The cam is a casting somewhat like the regular driveplate of the lathe, though of larger diameter and thicker in section, and is threaded to fit the spindle nose. The periphery is divided into as many lobes as there are lands upon the hob and each lobe is machined to the contour necessary to impart the required movement to the tool.

There is required, of course, a separate cam for each different number of lands, but they are inexpensive to make and the changing from one to another involves no more trouble than unscrewing one plate and substituting a different one, while the rigidity secured and the practical impossibility of error in setting up is believed to more than compensate for any slight advantage in the matter of convenience possessed by the standard attachments.

The compound rest is set parallel to the cross-slide and is available at all times for radial feeds. While the traverse movement of the carriage is not interfered with, it is necessary to set the latter in position to bring the roller at least approximately opposite to the cam and lock it there during the operation. To provide for axial movements or adjustments a special toolblock is fitted to the T-slot of the compound rest, and this block is adjustable by means of screws, micrometer dials and index plates.

Because of the necessarily limited amount of axial traverses permissible this device is not suitable for backing off taps or other tools in which the cutting edges are disposed in the form of a helix, but the number of hobs without lead required by the shops is sufficient to keep the machine busy nearly all of the time.

Reducing the Cost of Time Keeping

BY ALLEN P. CHILD

The device shown in the accompanying illustrations was developed and is in use by the Federal Products Corporation, Providence, R. I. for the purpose of re-

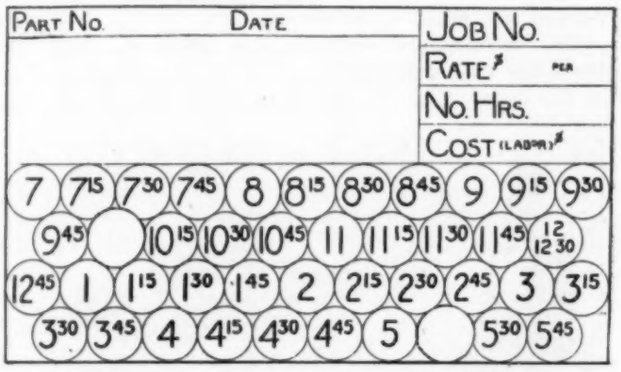


Fig. 1—The time card, punched for starting and stopping time

ducing the amount of clerical work required in handling time-keeping records.

The time card shown in Fig. 1, printed for the particular class of work, is divided into 15 minute intervals from a stated time in the morning until a stated time in the evening. When a piece of work is started a hole is punched in the card at the time indicated, or as nearly as possible to it, and when the work is completed the card is again punched at the proper place.

A loose-leaf binder containing seventy master cards, each card covering given prices per hour for labor in even cents and half-cents, is then used as shown in Fig. 2 to compute the cost of the job. The prices shown on the master card are figured in progression from one-

Fig. 2—Method of determining the cost from the master card

quarter of an hour up to and including eleven hours by quarter-hour intervals. In computing the labor cost the starting time hole in the time card is placed over the black spot on the master card, and by holding the time card in proper alignment the number of hours and the labor cost of the piece shows up through the hole indicating the stopping time.

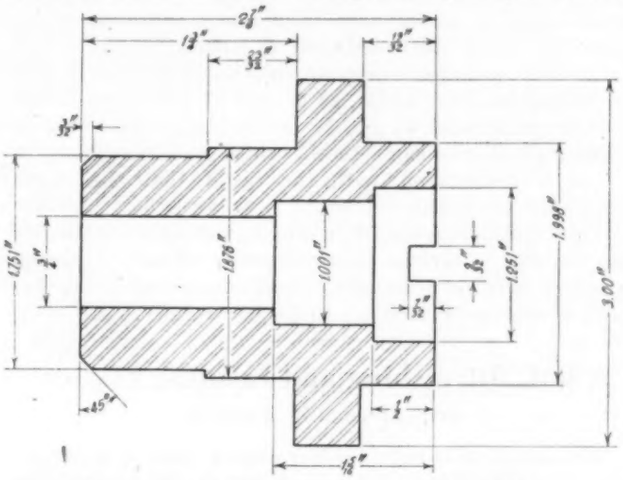
In order that they may be located easily the master cards are progressively indexed.

Poorly Dimensioned Drawings—Discussion

BY JOHN HOMEWOOD

Inasmuch as I am greatly interested in the art of drawing I cannot resist the desire to express my opinions pertaining to the drawing shown by Albert A. Dowd on page 301, Vol. 60, of the *American Machinist*.

Why show a view of a piece that is to be made on the lathe in such a position? Is it not more confusing for the lathe operator to work from a drawing placed vertically rather than horizontally? It seems to me that the first consideration of a draftsman should be the man who is going to make the part. The drawing is at the height of its usefulness when it is being used by him, and there



Another draftsman's idea of a properly dimensioned drawing

is where it should be made to excel. In the drawing accompanying the article, the piece is shown in the position it would occupy when in the lathe and the dimensions are so placed as to facilitate measurements.

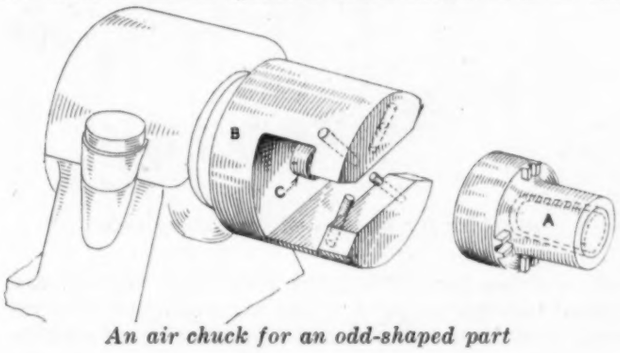
The idea of starting the extension lines with a few dots makes a neat drawing, but is it any neater than one where the extension lines have the regulation space of 1/32 in. between the line and the drawing? The dimensions down to the shoulders should be more definite; that is, the extension lines should be carried nearer to the object dimensioned. No one is a bigger crank on neat arrows than I am, but why make such large ones that they stand out like a flock of birds around the drawing?

As shown in my drawing the extension lines are carried across to within a small space of the point under consideration, and this fact does not make the drawing less clear; I would say that the reverse is the case. Another thing that I have been in the habit of doing for mere art's sake is to stagger the figures. My sketch is so dimensioned as to avoid having a lot of unnecessary lines, and there is no necessity to feel your way around to the object dimensioned, as is the case with the drawing shown by Mr. Dowd. It would be more interesting to know what the piece is for and where it is to fit, then one could go about dimensioning it properly with greater understanding. As it is, we can handle it only in a general way and make our criticisms as constructive as possible.

An Air Chuck to Hold Without Radial Pressure

BY R. GRANT

Having a number of small parts of cast iron, shaped as shown at *A* in the sketch and requiring a tapered hole in the projecting boss as the only machining operation, we devised the air-operated chuck shown at *B* to cut



An air chuck for an odd-shaped part

down the time of chucking to the lowest practicable limit. The four lugs, each having a radially disposed V-groove, were put on the casting for the sole purpose of enabling us to chuck it in the manner here described, and proved to be a profitable investment by virtue of the saving in machining cost.

On the inner faces of the two projecting bosses, or jaws, of the chuck, four pieces of drill-rod were placed at 90 deg. apart, with their axes radiating from the center. The holes into which the pins were driven, were drilled from the periphery of the chuck, so that there was ample metal surrounding each pin to support it in position, and as nearly half the diameter of the holes continued through the inner faces of the jaws, the pins were not subjected to shearing or breaking stresses.

An air-cylinder at the rear of the machine, acting upon the plunger *C* that extended through the machine spindle and bore upon the back of the casting, completed the chucking device. It will be noticed that the castings were instantly centered, both radially and axially, by coming to rest with the V-grooves in contact with the radial pins, and that there was no radial pressure upon the casting to distort it and render the finished taper hole untrue or out of round by release of the distorting pressure.

An automatic screw machine of uncertain antecedent, and a not altogether trustworthy degree of accuracy, was assigned to the job, and altered therefor, only by the addition of the air cylinder for chucking, and by an extra stop-dog to arrest the motion of the cam-shaft upon the completion of each cycle. Suitable turret tooling enabled a boy operator to produce 58 pieces an hour, with no possibility of error due to improper chucking.

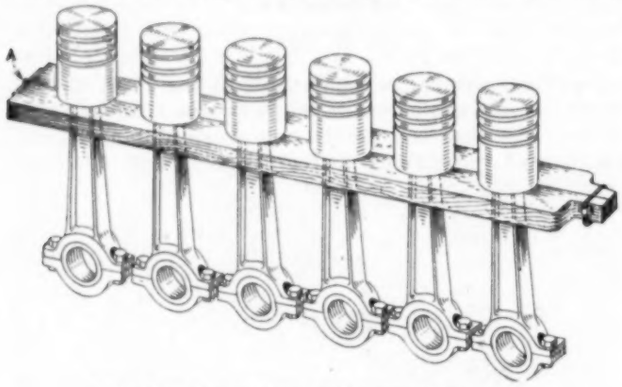
Though this method of chucking is not susceptible to wide application, the idea contained therein may serve to show some reader of the *American Machinist* the way out of his particular difficulty.

Connecting-Rod Assembly Holder

BY FRANK C. HUDSON

There are numerous methods of handling connecting rods both by themselves and in sub-assemblies with pistons in place. Boxes, trays and other methods are used in various plants.

Here is a method from a shop building a little six, which is simple and has proved very satisfactory. Two strips of hard wood, of sufficient length and provided



A holder for piston and connecting rods

with notches for holding the rods from moving, are hinged together as at *A* in the accompanying illustration. The other end is clamped together by a swinging loop which is fastened to one strip and goes over the other, holding the pieces firmly together.

The six pistons and rods can then be carried to the engine assembly by hand while hung on suitable racks in trucks, or in other ways. In any case they are prevented from injuring each other and the set which has been selected for weight and size, is kept together until it goes into the motor.

A Troublesome Interference that Could Have Been Avoided

BY A. W. JANNSON

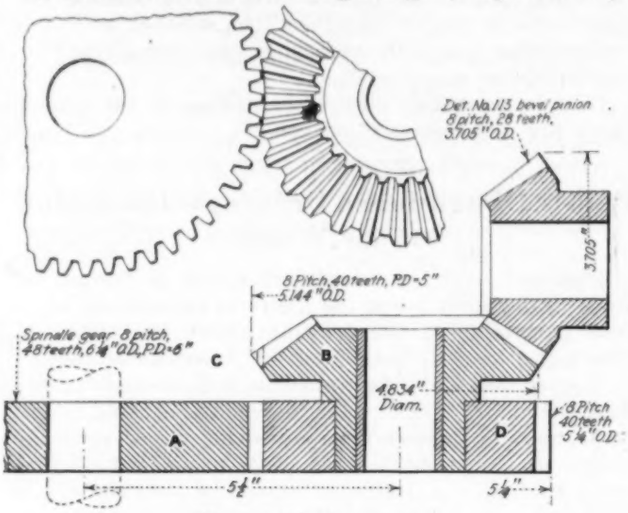
We have a number of special machines each having several spindles, and each spindle is driven by a train of gears, the arrangement of which is shown in the accompanying sketch. The gears are all hardened and run at rather high speeds.

The nature of the work done by the machines is such as to impose sudden and severe shocks upon the gears, and to guard against their destruction a safety device of the nature of a "breaking pin" is installed between each gear *A* and its respective spindle. When this pin breaks, as it not infrequently does, it is necessary to take gear *A* out of the machine to make repairs.

It would be very easy to do this by lifting the gear straight up if it were not for an oversight in the design of the machine, by which the bevel gear *B* overhangs gear *A* just sufficiently to interfere, and we have to spend a day in disassembling and reassembling the machine to accomplish a replacement that would otherwise have required but half an hour.

In order to forestall subsequent trouble from the same source, as fast as these parts were disassembled, a groove, as at *C*, was ground in the bevel gear *B* large enough to clear gear *A* as it is lifted from its spindle. It is now necessary only to turn the gears until the groove coincides with gear *A* in order to take the larger gear off.

It seems to me that as this gearing is subject to very



The interfering gears

heavy work it would have been much better to make gear *A* with 47 teeth and gear *D* with 41 teeth, as the ratio is of no importance and sufficient clearance would be gained thereby. Also, as 41 and 47 are prime numbers, it would take 41 and 47 revolutions respectively to come back to the same tooth, while it is now done in 5 and 6 revolutions, with the result that the gears wear very unevenly.

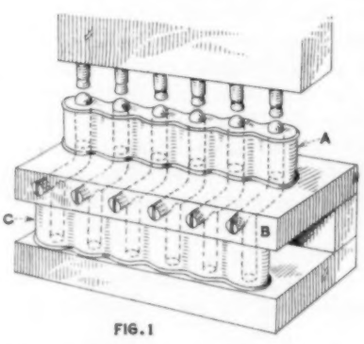
This trifling oversight in the matter of interference has caused us serious inconvenience. Would it not be well for machine designers to look into problems of this kind so that such troubles maye be avoided?

A Ball Burnishing and Loading Fixture

BY CLIFFORD H. FRENCH

The use of steel balls for burnishing holes after reaming has a number of applications in the automobile motor shop. A fixture for use in burnishing the push-rod guides on a Jewett motor is shown herewith.

The guides carry six push rods, there being two



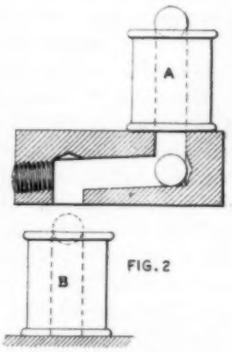


Fig. 1—Burnishing a push rod guide. Fig. 2—How the next guide is loaded

guides to each cylinder block. Balls are carefully selected for size and can be used for many holes, as they almost never go through the holes with the same surface in contact, so that the wear is very slight.

In the Jewett shop, the six holes are burnished at once as shown in Fig. 1, by a single stroke of the press. The ingenious feature, however, is the way in which the balls are fed into the next guide, without handling or loss of time.

The guide to be burnished is placed under the punches as at *A*, resting on the table *B*. A second guide, unburnished, is placed at *C*.

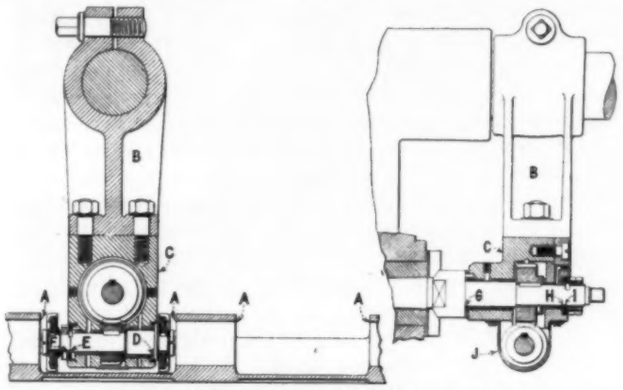
The table *B* is drilled with inclined passage ways under each guide hole as shown in Fig. 2. When the punches force the balls through the guide *A* they drop in a hole directly beneath, roll down the incline and drop into the holes of the guide *B*, Fig. 2, automatically loading it. Lifting this guide with the balls in place, to the upper table and placing a new guide beneath, the operation is repeated rapidly and with no handling of the balls. The holes in the block can be readily drilled as shown, or can be open channels as preferred. But the saving in handling of the balls is well worth while.

Device for Face-Milling Camshaft Housings

By R. E. D. Delrue
Steyr, Austria

We were confronted with the problem of face-milling or otherwise finishing the camshaft housings as shown at *A* in the accompanying sketch, and not being able to discover a way of doing it with the means already at hand, we devised the attachment for our milling machine here described.

A bracket *B* was made to be clamped to the overarm of the milling machine in the usual manner and to it



Device for facing camshaft housings

was bolted the housing *C*, which carries a short transverse spindle having provision at both ends for attaching face-milling cutters. This spindle is driven through helical gearing from the regular arbor of the milling machine.

The transverse spindle is hardened and ground, and runs in gun-metal bearings; the rings *D*, *E* and *F* taking the thrust of the cutters and gears. The driving arbor is also hardened and ground, and as there is considerable thrust upon this also, due to the action of the gears, thrust rings *G*, *H* and *I* are arranged to absorb it. A carefully adjusted plate *J* encloses the spindle and gearing and serves to keep out the chips as well as to retain the heavy motor oil with which the device is filled.

The device proved to be quite rigid, and, notwithstanding the rather small mills and the coarse feeds applied, worked very satisfactorily. The camshaft housing is clamped to a jig-plate on the table of the machine, which is first raised to bring the cutters in line with the camshaft bearings and then fed backward and forward against the respective stops.

Fixture for Machining Connecting-Rod Brasses

By O. L. Kampschaefer

In machining connecting-rod brasses, it is very important that the face that bears against the foot of the rod shall be at a right angle to the bore. Referring to

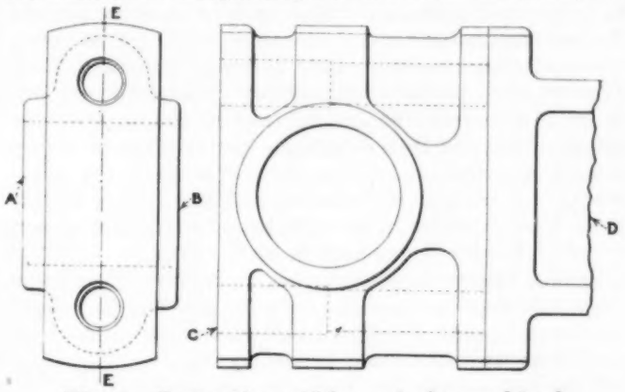


Fig. 1—Connecting-rod brass to be machined

Fig. 1 the faces *A* and *B* should be parallel with each other and at right angles with the faces *C* and *D*, and also with the bore.

The lathe fixture for machining the faces *C* and *D* is shown in Fig. 2. The pilot *A*, on the back of one leg of the angle plate, is for locating the fixture and fits in a corresponding recess in the faceplate of the lathe. The plug *B* in the other leg of the fixture is for locating and holding the work. The distance *C* must be

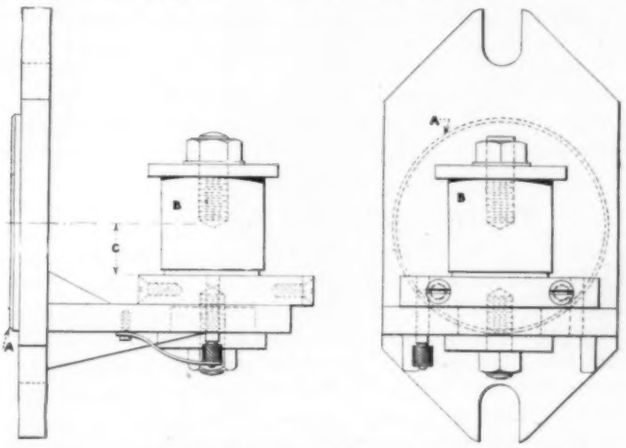


Fig. 2—Fixture for machining top and bottom of connecting-rod brass

such that the center line of the work, *E-E*, Fig. 1, will coincide with the axial center line of the lathe, while the plug *B* must be perpendicular thereto.

To insure the parallelism of faces *C* and *D* of the work, the plug *B*, is rotatable and provided with indexing mechanism, so that after one face has been machined, the work may be indexed 180 deg., bringing the opposite face into position to be operated upon.

American Machinist
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The Best Industry of All

NO INDUSTRY can exist for very long unless it can make a profit on the money invested in it. But what a dull and sordid affair a business must be where money is the sole incentive and there is nothing to relieve the monotony. Most men in industry possess the creative instinct, otherwise they would not be there. Those of them whose fortune has placed them in lines of work that produce nothing but financial profit are to be pitied even though the money they make may provide them and their families with the luxuries of our modern civilization. They can never have the inexpressible satisfaction of seeing a child of their brains grow from a vision to an actual productive instrument by which the lot of mankind is made easier.

Such a fate can never overtake a builder of machine tools. He may not have the luxuries that can be bought with ample profits from his business and his commercial craft may at times come perilously close to the rocks, but he has always the enduring satisfaction and the keen stimulus to further effort that come from a realization that the tool he builds is an indispensable factor in the life of our day.

Viewed only from the financial angle the business of making machine tools is rather a gloomy one and the men engaged in it may be forgiven for some little mutual commiseration. But the fact remains that this game of making the "master tools of industry" has a gripping fascination that is difficult to resist. The opportunity it offers for the expression of a man's creative instinct is hardly exceeded by any other field of endeavor. Probably many of the old timers who have grown up in the industry do not recognize the fascination that keeps them in it, but the newcomer in the field, the man who has been successful perhaps in some other line, is struck by it at once and usually succumbs to its lure.

Tax Reduction But Not Reform

PRESIDENT COOLIDGE has signed the Revenue Act and in so doing has made the most of a good opportunity to tell Congress exactly what he and many other thoughtful Americans think of the blundering that has characterized the recent session. In many respects the new law is an improvement on the old one but in others it is even worse. The inclusion of the so-called "publicity provision" is a beautiful example of how not to accomplish a desirable end. For one tax-evader caught by this means, a hundred upright and honorable business men will suffer from having their private affairs published for their competitors.

There is little question but that Mr. Coolidge acted rightly in signing the bill, particularly as he made it clear that he considers the question of tax reform to be a very live issue and one that must be met in the next Congress. The relief afforded to the smaller taxpayers will be very welcome and is sufficient justification for the President's act.

Business, however, stands to gain little because of the complete failure of the Mellon tax reform program. The ignorant, or crooked, politicians in Congress have perpetuated the farcical levy of an uncollectible surtax on large fortunes, uncollectible because tax-exempt securities exist in such quantities.

The voters will do well to scrutinize every candidate in the next election to see where he stands on tax reform. If he favors the present arrangement because of ignorance he has no business in a law-making body. If he favors it for political ends he is unfitted for public office of any kind.

Use Safe Containers for Small Products

GOOD judgment is not only vital in the design and the building of new machinery but is equally necessary in many of the smaller things which go to make up a business. Knowing just when to save a few cents is frequently as important as when to spend money for improvement.

A case in point is in the packages in which machine screws and similar products go to the consumer. The package is obviously useful only for holding the screws from the time they leave the manufacturer until the consumer uses them in the machines he is building. Any unnecessary expense in the package is, of course, a waste except in so far as it may have an advertising value. But it is also a mistake to put even machine screws in a package so cheap that it falls apart either before it reaches the consumer.

We know of at least one instance where the adoption of a flimsy package for machine screws switched a valuable customer to the use of screws of another maker. For it is very annoying to have packages break open in transit and strew the contents broadcast. In the same way a flimsy package allows screws to be lost in the shop, on floors and work benches and is a real source of grievance to the man who pays the bills.

To a small degree this may be compared to the uneconomic practice of shipping machines in poorly made crates which inadequately protect them from damage and loss of parts. In both cases the customer is fully justified in objecting to the judgment displayed in selecting the container used. And in the case of small products it is not unusual to have the containers play an important part in the demand for the articles themselves. Attractive containers are usually necessary, but they need not be flimsy and no product should leave the factory in containers that will not insure safe delivery to the customer.

An American Screw Thread Standard

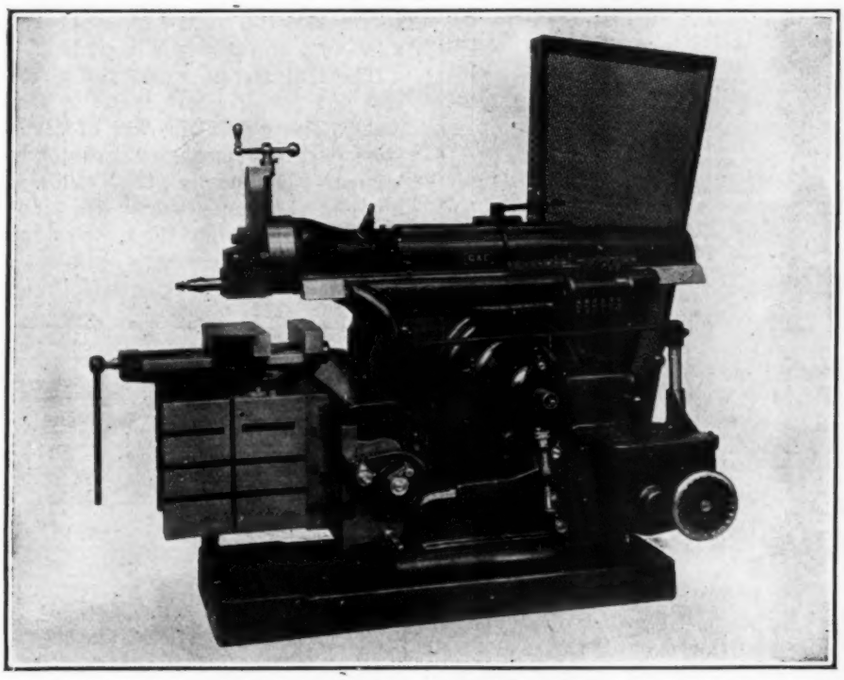
ONE of the most important events at the recent meeting of the A.S.M.E. was the presentation of a report giving the details of the American Screw Thread Standard. Including as it does the most widely used of current standards for screw threads for various purposes, the new standard will occasion but little change in existing practice. It will probably be only a short time before threaded pieces that do not conform to the standard will disappear from use.

Shop Equipment News

Improvements in Gould & Eberhardt Shapers

Gould & Eberhardt, Newark, N. J., announce a number of added features and improvements in their entire line of shapers. The basic design and general lines of the machines have not been changed. The improved operator can read the speed of the machine in strokes per minute.

The starting and stopping lever has been made longer for the convenience of the operator. A lock has been provided for the tool-head slide.



Gould & Eberhardt Improved Shaper

32-inch shaper is shown in the accompanying illustration.

A multiple gravity oiling system is being provided to automatically lubricate all of the main internal bearings. The gravity system is used in preference to the forced-feed system because the shafts do not run at very high speeds and therefore require only a moderate amount of oil. This system permits the operator to turn the oil on or off as required, depending upon how hard the shaper is being run.

The lever for shifting the gears in the speed gear case has been moved from the bottom to the top of the case where the operator can reach it much more easily. An index plate is provided, so arranged that the

The handle for clamping the ram-adjusting nut is now a drop forging. The movable vise jaw is made with a solid top which is machined accurately and provides more surface for surface gages when squaring up work.

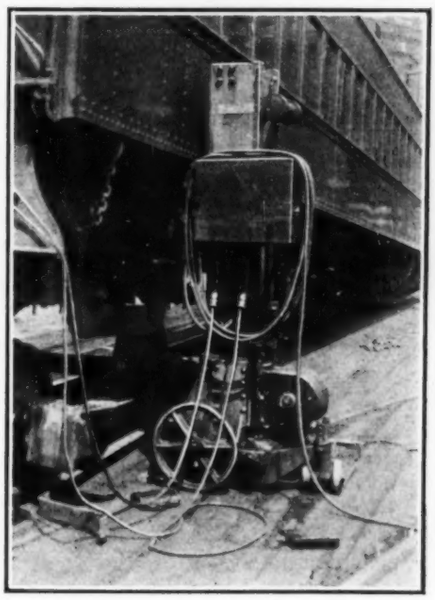
The guard for the cross-rail is made of sheet metal and provisions are made to prevent the chips from getting under the guard and back of the slide. Means are provided for oiling the cross-slide and oil wipers are attached on all of the cross-rail bearings.

Whiting Portable Car Hoist

The portable car hoist illustrated has just been introduced by the Whiting Corporation, Harvey, Ill.

It embodies the same basic principles as do the Whiting locomotive and car hoists which are in wide use. The portable unit makes unnecessary a special foundation or pit, and extends the use of these hoists to any point in the shop or yard where there is a level floor capable of supporting the load. They are easily portable. As power is required to lower the hoist a car can be supported on hoists without blocking, and can be left over the noon hour or over night without danger.

Application of the hoist is claimed to be general. When removing trucks, four hoists are used, two at each end of the car, permitting the trucks to be grouped and handled together. When removing one, two or



Whiting Portable Hoist

three pairs of wheels, or renewing springs, two hoists are used and the truck is supported by suitable clamps from the under frame of the car during the lifting operation.

The Whiting hoist is a motor-driven screw jack mounted in a substantial frame with three bearing surfaces, spaced to give maximum stability. One, two or four hoists can be operated as a unit, the control being centralized in one push-button station.

LeBlond Rapid Traverse for 17-In. Rapid Production Lathe

The 17-in., heavy-duty, rapid production lathe manufactured by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, and described on page 226, Vol. 60, of the *American Machinist*, is now being marketed with a power rapid traverse. This device has been developed as a means of increasing production through added convenience for the operator, as it enables him to quickly approach the cut and return the carriage to the starting position.

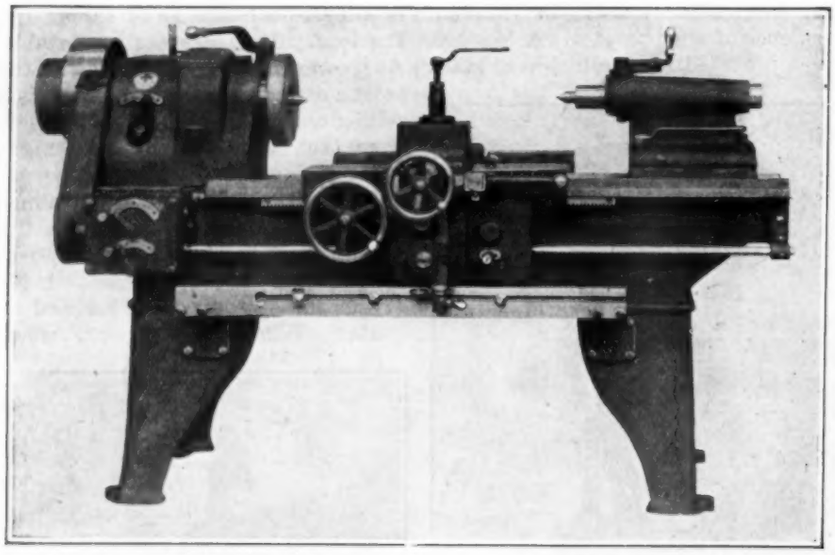


Fig. 1—LeBlond Rapid Traverse for 17-in. Rapid Production Lathe

The mechanism is simple in its operation since both feed and traverse are controlled by a single conveniently-located operating lever. The lever is mounted on the carriage to the right of the cross-feed handwheel, as shown in Fig. 1. Movement of the lever in the horizontal plane engages and disengages the feed, and movement in the vertical plane controls the traverse in both directions. A neutral position is provided to which the lever automatically returns when the pressure in either direction is released. The feed positions are located by a spring plunger, the lever in these positions controlling the action of the positive feed clutch.

The feeds and traverse are positively interlocked so that it is impossible to engage the traverse while the feed is in action. The traverse is engaged by a slight pressure on the control lever and continues until the pressure is released, the carriage stopping immediately at the desired position.

The driving mechanism is shown in Fig. 2 and consists essentially of a substantial housing bolted to the back of the carriage through which passes a right- and left-hand traverse screw of coarse pitch. Two substantial nuts are carried in the housing, one of the nuts engaging the right and the other the left-hand screw. The movement of the lever in the vertical plane is transmitted through a shaft and a steel clutch finger to a positive sliding double clutch that can be engaged with either of the nuts.

The screw is revolved at constant speed, being driven from the driving pulley of the machine through a belt and pulley and a system of differential reduction gearing. The rate of traverse is uniform, the traversing speed being 150 in. per min. An automatic traverse stop is provided at the tailstock and, in conjunction with the automatic apron stop for the feed, gives an automatic stop in both directions.

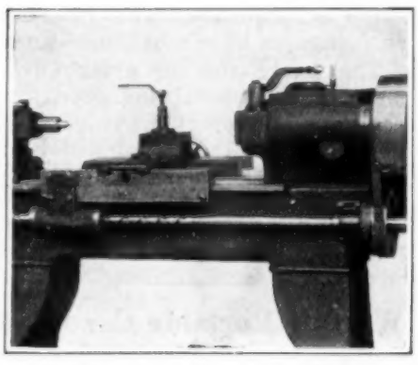


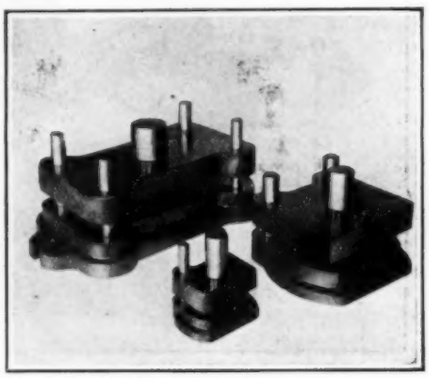
Fig. 2—Driving mechanism for LeBlond rapid traverse

The spacing bar shown below the carriage in Fig. 1 can be furnished if desired. This device combines positive adjustable length stops for both traverse and feed, and is particularly valuable for shoulder work or work with a comparatively short traverse stroke. Two traverse dogs and four feed dogs are regularly furnished with the bar.

Bilton Die-Sets

The Bilton Machine Tool Co., Bridgeport, Conn., is now marketing a line of standard die-sets to relieve the average toolroom of the necessity for making up such sets every time a new die and punch is designed.

The material of which the die-bed and punch-holder are made is semi-steel. The guide pins are of carbon steel, carefully hardened, ground and lapped. Ordinarily the guide-pin holes in the punch-holder are lapped to fit the pins, but these holes may be fitted with renewable bushings of hardened steel if desired. Punch-holders may have permanent round or square stems for attaching them to the gate of the press in which they are to be used, or they may be fitted with floating shanks so that the contained tools are guided entirely by the pins of the die-set.



Bilton Die-Sets

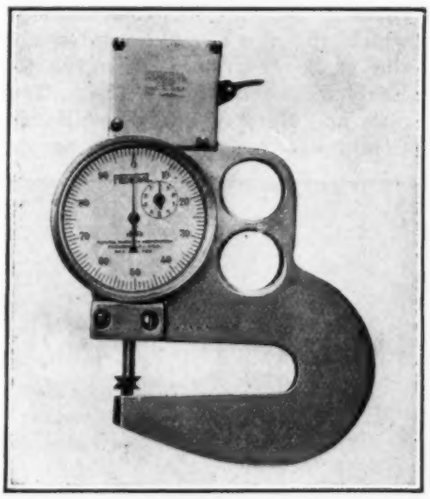
If an equal number of guide-pins are symmetrically disposed in the set, the diameter of one or two is different than the others so that the set must always go together in the same way. Six standard sizes of sets are made and carried in stock in 53 sizes. Six special styles with a range of 40 sizes can be furnished on order. The weights range from 18 to 525 lb., according to style and size.

Federal Model 22 Thickness Gage

The Federal Products Corp., 15 Elbow St., Providence, R. I., has recently placed on the market its Model 22 thickness gage to supplement its regular line and increase the range of thicknesses to which these gages may be applied.

The frame of the gage is made of aluminum to insure lightness combined with ample strength, and is designed to be grasped conveniently by the operator when it is to be used continuously, as in inspection work. The measuring spindles are hardened and ground, and can be furnished with either flat or round ends. The range of spindle movement is such that stock up to 0.005 in. in thickness may be measured. The depth of the throat is 2 inches.

Federal dials C, D, E or F can be furnished with the instrument as desired, to read in 0.001 or 0.0001-in. cumulative measurements or plus-or-minus variations from zero. The finger lever at the top of the instrument enables the operator to open the measuring jaws for the purpose of inserting the work.



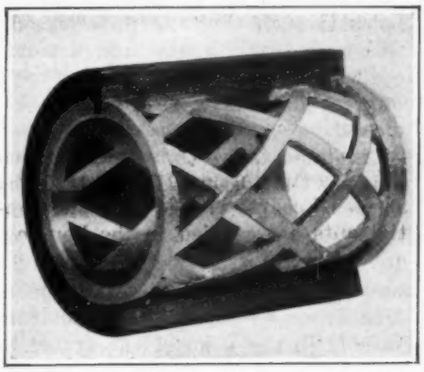
Federal Model 22 Thickness Gage

U. S. L. Self-Lubricating Bearing

A self-lubricating wood bearing with a babbitt reinforcement cast in place is now being marketed by the Universal Self Lubricating Bearing Corp., Lincoln, N. J. The bearing is shown in the accompanying illustration with part of the wood shell removed to show the reinforcement.

The shell is made of a selected grade of hard maple and is impregnated with lubricating oil suitable for the service that the bearing is to perform. The grooves for the babbitt are cut in the bore of the shell and the babbitt is then cast in the grooves. The inside of the bearing is then reamed to the proper size and presents alternating areas of wood and babbitt.

The babbitt reinforcing core is said to decrease the effect of atmospheric conditions on the wood shell and to add substantially to the strength and durability of the bearing.



U. S. L. Self-Lubricating Bearing

Buffalo Railroad Shear, Punch and Bar Cutter

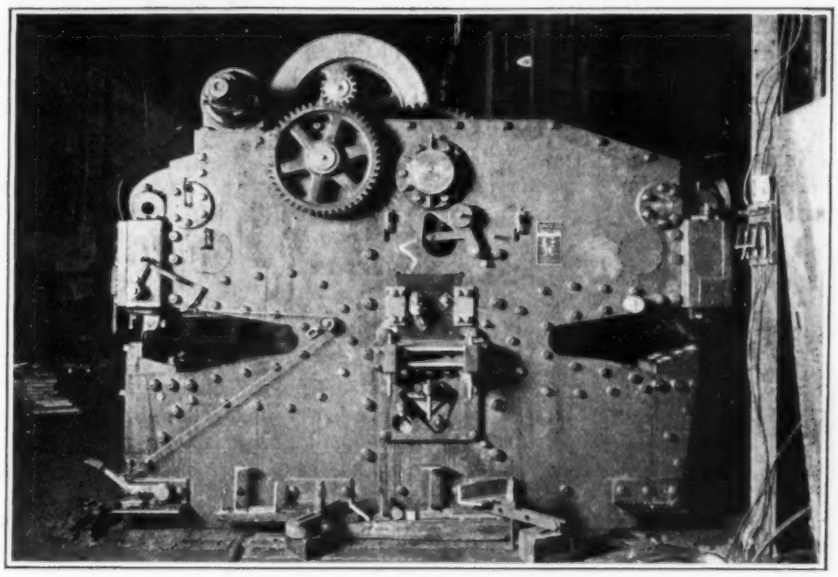
A combined shear, punch and bar cutter especially adapted for use in railroad shops has recently been placed on the market by the Buffalo Forge Co., Buffalo, N. Y. The machine is shown in the accompanying illustration and it will be noted that the general design and construction of the machine is similar to that of punching is to be done the knife on the shear end of the machine can be removed and replaced by punching tools, so that both ends of the machine will be available for this work.

Steel gears and nickel-steel pinions are used throughout, providing a substantial saving in strength, weight and space required over cast-iron former machines of this type manufactured by this company.

In such work as locomotive repairs few of the operations are standardized, so that an important feature of this machine is a universal bar cutter arrangement. The bar cutter can be used for rounds, squares, angles, flats and tees without changing knives. Structural shapes can also be cut, but a different knife is required for each size and shape of section.

When a considerable amount of gearing. All bearings are bronze-lined and have ample provision for oiling. Either pulley or motor drive may be used. The punch is provided with a gag, making it semi-floating, and can be engaged either by handle or treadle. The frame is constructed of armor plate and provides ample strength for the service required.

The punching capacity of the machine ranges form 1x½-in. for the smallest size to 1¾x1½-in. for the largest. The slitting capacity ranges from ½- to 1½-in. plate.



Buffalo Railroad Shear, Punch and Bar Cutter

Manhattan Swing-Frame Grinder

A swing-frame grinder of the semi-portable type has recently been developed by the Manhattan Rubber Co., Passaic, N. J., and is being marketed by the Riverside Production Co., Newark, N. J. The novel features are the means for altering the point of suspension to maintain

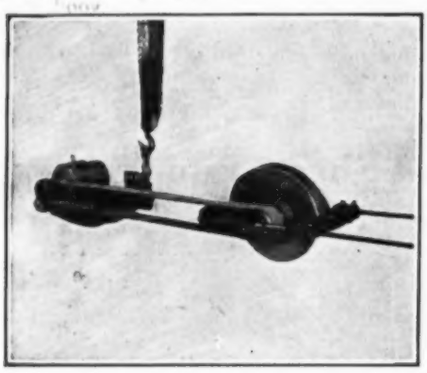


Fig. 1—Manhattan Swing-Frame Grinder

the frame in balance as the wheel wears, and the method of mounting the wheel itself, so that wheels may be changed easily and quickly.

The frame is suspended from a chain fall or similar support in the usual way, so that it may be readily adjusted to a convenient working height and swung about freely within a reasonable range. When

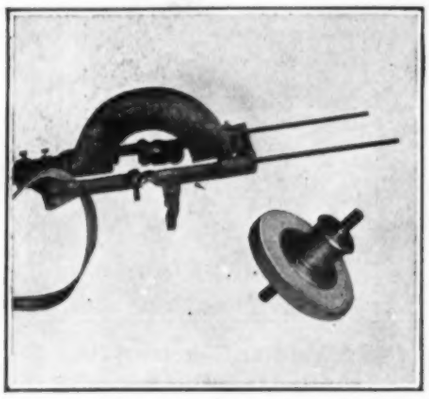


Fig. 2—Manhattan wheel mounting

the wheel is new the hook is attached to the outer one of the row of holes in the upper edge of the suspension plate, as shown in Fig. 1. As the wheel wears, the point of suspension is moved back from hole to hole along the row, thus keeping the frame always in equilibrium. The suspension plate is held by clamping bolts to the central member of the frame upon which its position is adjustable, but the disposition of the holes is such that the difference in weight between a new and a worn-out wheel is covered and adjustment of the plate is not ordinarily required.

An important feature of the machine is the "dead" wheel-spindle, by means of which other types of frame may be used without great alteration to secure the benefit of the quick and easy method of changing wheels. The arbor on which the wheel runs is held in the yoke of the frame by means of two swinging clamps, Fig. 2, and to loosen two bolts and drop the wheel and arbor out of the frame requires little time.

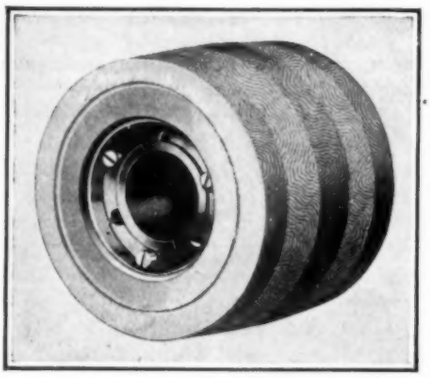
The wheel has a 3-in. face and the diameter, when new, is 24 in. The center hole is 12 in. in diameter, allowing the use of a substantial ball-bearing support in the plane of rotation of the wheel. This main bearing is designed to sustain both radial and axial thrust and a smaller ball-bearing at the outer end of the pulley steadies the revolving wheel-center and belt pulley and takes the load of the driving belt.

The driving motor is mounted upon an offset drop-bracket that is designed to balance the weight of the motor against that of the wheel-head and maintain the frame in equilibrium sidewise. The machine as shown is equipped with a 15-hp. Continental d.c. motor, but other motors can be used. An endless rubber driving belt is supplied with the machine.

Dodge Motor Pulley

The pulley illustrated herewith has lately been brought out by the Dodge Manufacturing Corp., Mishawaka, Ind., and consists of a wood-rim pulley having an iron center.

The wood rim is made of selected stock, laid up in segments and glued



Dodge Motor Pulley

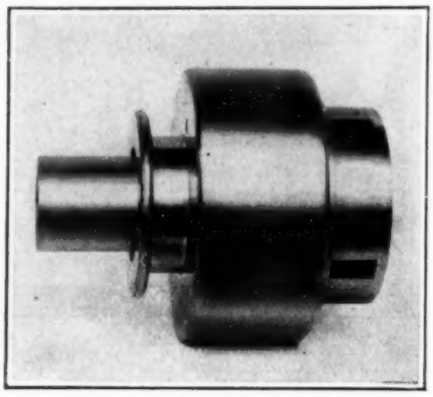
under heavy pressure. A seamless steel tube is forced into the wood rim and securely interlocked. An iron bushing, slit longitudinally and tapered at each end, and two iron wedge rings together with the screws by which they are adjusted, complete the equipment.

With the wedge rings interposed between the bushing and the bore of the pulley, it is necessary only to draw the rings toward each other with the screws to compress the bushing on the shaft and expand the rings in the bore, thus holding the pulley tightly on the shaft.

No tool, other than a screwdriver, is necessary to apply or remove the pulley. The compression of the bushing is so great that keys or setscrews are not required to hold the pulley against slipping on the motor shaft.

H & G Style AA Diehead

For use on such machines as the Acme automatic screw machines, in which the die spindle rotates and the stock remains stationary, the Eastern Machine Screw Corp., Truman and Barclay Sts., New Haven, Conn., has recently placed on the



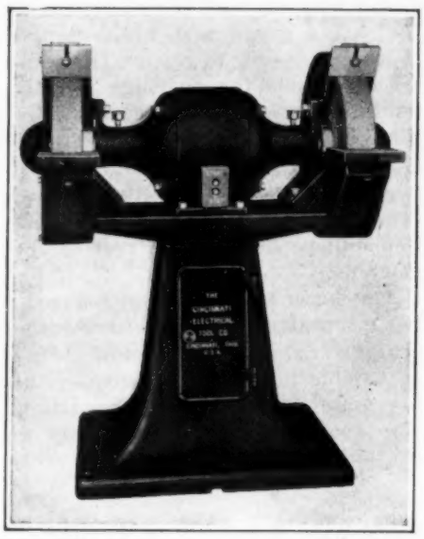
H & G Style AA Diehead

market its style AA diehead. An accurate adjustment for the length of thread cut is provided and the automatic trip is positive in its action, operating quickly and effectively to open the head.

The diehead is closed by compressive action caused by the backward movement of the die spindle. The outer shell of the device has a spool at the back for a yoke and, when the forward motion of this yoke is stopped, the diehead immediately trips. The backward motion of this yoke, as the spindle recedes from the work, is arrested by a stop, automatically closing the head in readiness for the next piece.

Cincinnati 5-Hp. Heavy-Duty Floor Grinder

A floor grinder, suitable for heavy grinding in railroad shops, foundries and similar establishments, has recently been added to the line of portable electrical tools manufactured by the Cincinnati Electrical Tool Co., 1501 Freeman Ave., Cincinnati, Ohio. The 5-hp. driving motor is equipped with ball bearings and is fully enclosed to prevent the entrance of dust and grit.



Cincinnati 5-Hp. Heavy-Duty Floor Grinder

The spindle will carry wheels up to 18 in. in diameter with a 3-in. face. The wheel guards are of the exhaust type to comply with all safety standards and are adjustable for the wear of the wheels. Removable covers bolted to the guards completely enclose the wheels.

The starting switch is of the magnetic type and is operated by a push-button control. The switch is mounted on a separate panel within the column. The motor can be furnished for 2- or 3-phase alternating current, 220 or 440 volts, and from 25 to 60 cycles.

Electric Arc Cutting and Welding Co. "Taperod"

A tapered electrode called the "Taperod" is being placed on the market by the Electric Arc Cutting and Welding Co., 152-158 Jelliff Ave., Newark, N. J. The rod is designed to be gripped in the electrode holder by its larger end so that the smaller end may be used to start the arc. As the heat builds up during the process of welding, the constant and uniform increase in the thickness of the electrode provides heat compensation. The object of the tapered rod is to make it possible for the welding to be carried on with uniformity without the necessity of changing to a heavier rod as the heat increases.

The maker of "Taperod" states that the gradual increasing diameter allows a corresponding increase in deposition with a constant heat value in the work deposit; that the heating of the rod due to resistance loss is compensated for by the larger diameter of that part of the electrode which carries the current the longest; and that waste ends are reduced to a minimum because the "Taperod" does not become red hot as it gets short.

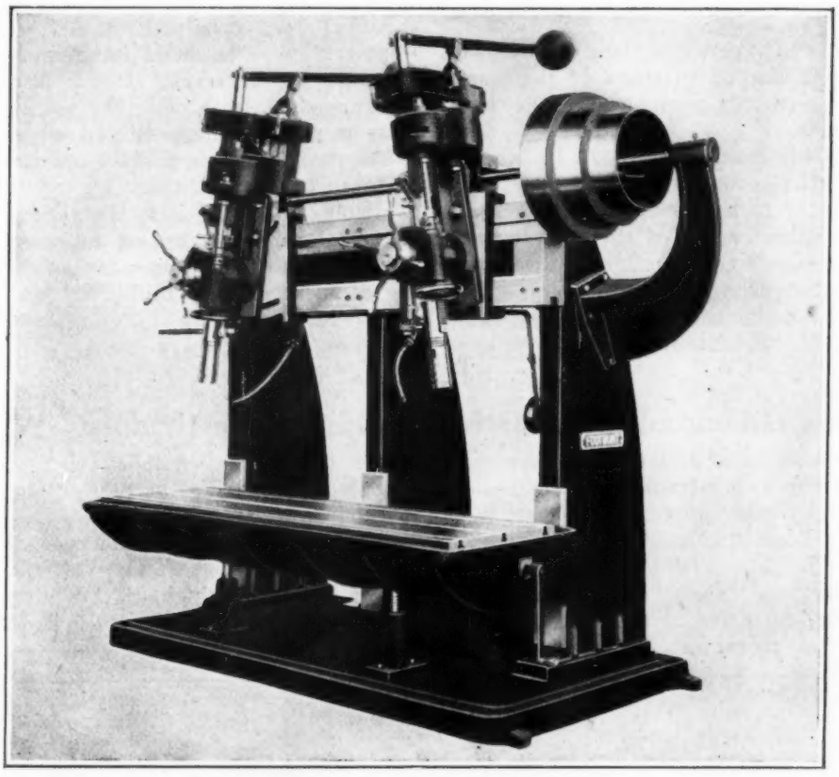
It is claimed that the tapered electrode permits increased speed and greater deposition. The tapered electrode facilitates starting welding in narrow corners and reentrant spaces.

Foote-Burt Axle Drilling Machine

A recently marketed product of the Foote-Burt Co., Cleveland, Ohio, is the front axle drilling machine shown in the accompanying illustration. The machine is designed to drill the king-bolt holes in axles, the drilling angle being adjustable to suit the requirements of the job.

The design incorporates the standard heads of the Foote-Burt high-duty drills, together with the upsaddles, so that each head can be inclined at any angle up to 15 degrees either side of the vertical position. This arrangement provides for drilling the king-bolt holes at the various angles specified in different axles.

Each spindle sleeve has a double feed rack to equalize the drilling thrust. There are four changes of feed, and three changes of speed are available without the back gears. Back gears are provided as special equipment to increase the range of spindle speeds. The machine illustrated is furnished with a right-hand drive but a left-hand drive is the standard arrangement.

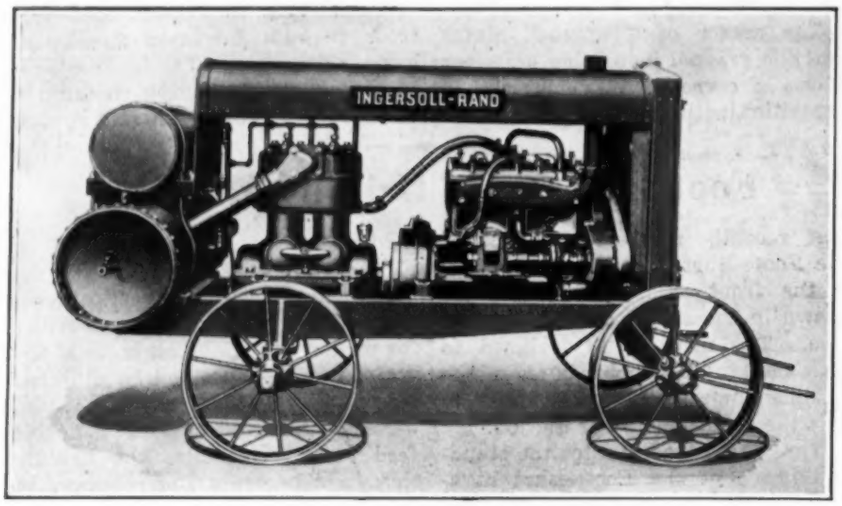


Foote-Burt Axle Drilling Machine

rights, cross-rail and table of the independent type machine. The construction is simple and the machine is readily adaptable to the requirements of all classes of the work for which it is intended. The heads are carried in a swivel arrangement in

Ingersoll-Rand Portable Air Compressor

The portable air compressor shown in the accompanying illustration has been placed upon the market by the Ingersoll-Rand Co., 11 Broadway, New York, and is designated as the 4½x4-in., Type Twenty. The compressor has a piston displacement of 60 cu.ft. per min., and is built on lines similar to those of the larger type-twenty portables of the same make.



Ingersoll-Rand Portable Air Compressor

This machine embodies a duplex, vertical compressor directly connected to a four-cylinder, four-cycle gasoline engine of the tractor type; enclosed construction; circulating water-cooling system for both engine and compressor; compressor regulator and engine control for reducing speed during unloaded periods; one piece, cast-steel frame; sheet-steel roof and removable side doors.

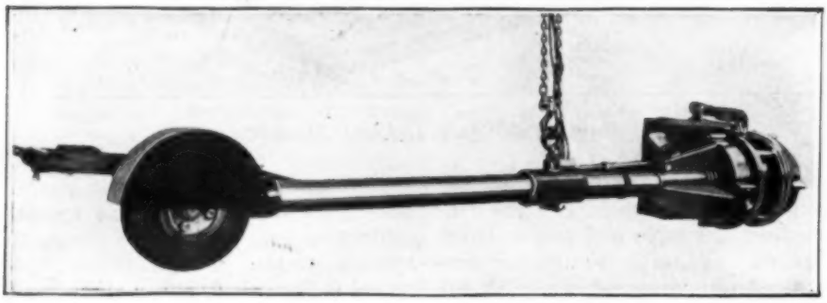
The machine can be furnished mounted on steel wheels and axles; wooden artillery wheels with solid-rubber tires and steel axles; on a Ford truck; or on skids for mounting on a car or truck. It can also be furnished with electric motor drive in place of the gasoline engine.

The machine being portable, it can be taken to any job where air is not available and can also be taken around the shop or yard of the home plant for repair work or spray painting at such times as nights or Sundays when the regular compressor is not in service.

Diamond Motor-Driven Swing-Frame Grinder

A series of direct-connected motor-driven swing-frame grinders has recently been placed on the market by the Diamond Machine Co., Providence, R. I. The machine is built in two sizes, the smaller of which carries a 12x2-in. grinding wheel driven by a 3-hp. motor at 1,800 r.p.m. The larger grinder is equipped with a 5-hp. motor that runs at 1,200 r.p.m. and drives an 18x4-in. wheel.

The motor is carried on a special end-piece rigidly fastened to the hollow arm in which the driving shaft revolves. At the wheel head end there is a set of nickel-steel spiral bevel gears for driving the wheel, fully enclosed and running in oil. All shafts are fitted in ball bearings of ample capacity mounted in dust-proof housings. The grinder is supported by a standard 8-in. chain hoist, the chain being attached at the center of gravity of the machine.



Diamond Motor-Driven Swing-Frame Grinder

An important feature of the machine is the accessibility of the grinding wheel, which can be removed by taking off the side plate of the safety guard and wheel flange. It is unnecessary to remove the spindle or expose the bearings so that readjustments are not required after changing wheels. The wheel head is arranged to swivel so that the wheel may be rotated through 90 degrees each side of the vertical position, independent of the rest of the machine.

The motor is equipped with a push-button control attached to the operator's handle, the handle being adjustable to any angle between the horizontal and the 45-deg. position. The starter is fastened directly to the motor.

South American Trade Shows Increase

The trade of the United States with Latin America for the first quarter of 1924, amounted to $477,949,891, a gain of about ten million dollars over the first three months, and approximately eighty million dollars above the total for the last quarter of 1923, according to an analysis by the Latin American Division of the Department of Commerce. Our imports from Latin America were $305,659,540, and our exports to that region were $172,290,351. Imports were some two million dollars below the first quarter, but about eighty million more than the last three months of 1923; exports were about twelve million higher than during the first quarter, but approximately two million less than for the last quarter of 1923.

The total trade of the United States with Latin America for April, 1924, amounted to $167,338,352, a decrease of $6,980,706 from the total for April, 1923, which was $174,319,058. Our imports from Latin America in April were $95,744,885, against $113,519,029 for April, 1923. Our exports to Latin America were $71,593,467 in April, compared with $60,800,029 for the corresponding month a year ago.

Our Electrical Exports

Preliminary figures of the Department of Commerce for the month of April show United States exports of electrical material valued at $7,420,420, compared with $5,967,647 worth shipped during the same month of 1923. This brings the total for the first four months of 1924 up to $29,463,892.

News of the Week

Farrell Tells the Foreign Trade Council to Expect Business Improvement

Many noted speakers at annual session held in Boston

With the general theme of "Our Need for Wider Markets" and an imposing list of nationally known speakers, the eleventh annual convention of the National Foreign Council was held in Boston, June 4, 5, 6, and 7. The attendance this year, estimated at 1,500, was extremely satisfactory and it was the general consensus of opinion that the amount of work accomplished was greater than at previous meetings.

James A. Farrell, president of the United States Steel Corp., called the first meeting to order in the Ball Room of the Copley-Plaza and after addresses of welcome Mr. Farrell delivered his annual address on the topic, "Wide Markets for American Products."

"As business men," he said, "we know that emotional reactions are temporary, that as a Nation industry and agriculture will not for long thrive on the medicine of pessimists. There are indications that we are getting out of the mood of unjustifiable depression. It has lasted long enough and a reaction to considered optimism is not far off."

The General and Group Sessions

Following a general session in the morning and group sessions for consideration of specialized subjects in the afternoon, there was an informal dinner under the auspices of the Export Managers' Club of New York in the evening. This was succeeded by addresses on the problems of the export manager. There was also an informal meeting of the foreign department executives of banks at which W. Irving Bullard, vice-president of the Merchants' National Bank, presided in one of the hotel parlors.

H. H. Morse of the bureau of foreign and domestic commerce in Washington, was the first speaker at the export managers' meeting. His address dealt with "Finding the Prospect." He was followed by D. W. Fernhout, export manager of the Manning Abrasive Co., who analyzed various ways of closing sales, and by Philip B. Deane, export manager of the Yale Safe & Lock Co., who talked on methods of developing the buyer into a customer. A. Schoonmaker, president of the club, also made a brief speech.

On Thursday morning the chairman presiding was Mr. Bullard and the speakers were: T. C. Powell, vice-president of the Erie Railroad; Franklin Remington, chairman of the board, the Foundation Co., New York; and J. J. Donovan of the Bloedel-Donovan Lumber Mills, Bellingham, Wash.

The group meetings on Thursday afternoon were on "Overcoming Export Obstacles" and "Importing Problems." At the first, W. W. Nichols of the Allis-Chalmers Co., presided with W. P. F. Ayer, vice-president of the Walworth Manufacturing Co., Boston, acting as Conference Chairman, and Harry W. Hanson as secretary. Speakers at this session were: O. T. Erickson, the Carter's Ink Co., Boston; Thomas W. Pelham, the Gillette Safety Razor Co., Boston; C. M. Wynne, the Overseas Trading Co., Chicago; and William G. Marvin, Marvin & Pleasants, New York. At the Importing Problems meeting, F. N. Shipley, George C. Davis and Ralph T. Hale were the speakers.

On Friday two more group sessions were held with C. C. Martin of the National Paper & Type Co., New York, acting as chairman of the meeting on "Foreign Credits and Credit Information," and Carl F. Propson, the Bausch & Lomb Optical Co., Rochester, acting as chairman of the "Advertising in Foreign Trade" group. Interesting discussions and talks were enjoyed at both meetings.

"America and the Dawes Plan" was the title of the speech delivered Friday afternoon by Fred I. Kent, vice-president of the Bankers' Trust Co., New York City. Other speakers were F. P. Foisie of Seattle, and Leigh C. Palmer, president of the Fleet Corp., Washington, D. C.

The last day of the meeting was devoted to entertainment and many of the delegates took this opportunity to make tours of inspection to the Boston Harbor and other points of interest.

England May Buy More American Autos

May has been a month of uncertainties in British industry, but without serious consequences, says Commercial Attache W. S. Tower in a cable to the Commerce Department. Threatening labor disputes in important industries, notably coal, building trades, and shipyards, were followed by encouraging progress toward peaceful settlement. Agitation over the repeal of the McKenna duties has largely subsided and the atmosphere generally, industrial and political, is clearing. The number of unemployed registered on May 19 was 1,021,000.

Importers of American cars are confident that the removal of the McKenna duties will stimulate sales and double the present volume. Several firms have already reduced prices by 12½ per cent on the average to forestall delay in buying until Aug. 1. Other reductions are expected after that date. It is rumored that British manufacturers propose advertising propaganda in favor of British cars. Sales during May were good, and British light car makers are working to capacity. The present market is decidedly a rising one.

Machine Tool Exports for April

Export of metal working machinery during April, 1924, with revised comparative figures for April, 1923, as compiled by the Department of Commerce, are shown by the following:

	April, 1923 Value	April, 1924 Value
Lathes	$66,001	$86,850
Boring and drilling machines	107,432	28,866
Planers, shapers and slotters	20,554	14,438
Bending and power presses	4,142	22,471
Gear cutters	9,724	43,695
Milling machines	26,320	30,524
Thread cutting and screw machines	27,362	32,570
Punching and shearing machines	10,235	9,753
Power hammers	8,153	10,963
Sharpening and grinding machines	69,678	.....
Chucks, centering, lathe, drill, etc	25,800	23,088
Reamers, cutters, drills, taps, dies and other metal-working tools	201,140	145,594
Pneumatic portable tools	58,906	105,156
Foundry and molding equip.	37,594	11,813
Other metal-working machinery and parts of	343,170	382,698
Metal-working machinery, (Total)	$1,017,307	$1,050,544

Plenty of Freight Cars on Hand

First-class railroads of the United States had on hand 331,012 surplus freight cars on May 22, according to the Car Service Division of the American Railway Association. This was an increase of 11,906 compared with May 14.

On account of the slack movement of coal and surplus coal cars on hand totaled 170,333. Surplus box cars numbered 123,879; surplus stock cars 17,314 and surplus refrigerator cars 12,544. There is no car shortage anywhere in the United States.

The report further discloses that the freight cars in need of repair on May 15 totaled 182,144, or 8 per cent of the total in use, while the locomotives in need of repair numbered 11,866, or 18.4 per cent of the total.

Notes of Washington Activities

By Paul Wooton

After various stormy sessions of the conferees, the Senate and the House finally were brought into accord in the matter of repairing Shipping Board vessels by providing that "unless the President shall direct otherwise, no part of the monies appropriated shall be used for the repair or reconditioning of any vessel, if the expense is in excess of $50,000, until a reasonable opportunity has been given to the available Government navy yards to estimate upon the cost of such repair or reconditioning, if performed by such navy yards within the limit of time within which the work is to be done."

The original proposal which would have required most of the Shipping Board's work to be done in the navy yards was opposed very strongly by those who think private shipbuilding plants should be encouraged if we are to have an American merchant marine. There was much opposition in the Senate to legislation which would mean the ruin of many private plants, were the policy continued indefinitely. The Senate finally agreed to a proposal giving the navy yards preference on jobs exceeding $100,000. The limitation finally was reduced to $50,000.

While the Department of Commerce, by the narrow margin of ten votes, lost its bill providing a statutory existence to its foreign service, the consideration of the measure has had the effect of impressing Congress with the importance of its work.

The defeat of the measure may be laid directly to the Secretary of Agriculture, who championed a "dog-in-the-manger" policy on the part of his own foreign staff. It was brought home with particular clearness to the House that every state does an enormous export business. Even Nevada, which was at the foot of the list of all the states, shipped $61,000,000 worth of products to foreign markets in 1923. The state of New York exported its products to the extent of $183,000,000 in 1923. Texas added $147,000,000 to a grand total of $1,084,000,000. The increasing interest in foreign trade was cited by the fact that the department received 505,000 written inquiries in 1921, but thus far in 1924 is receiving such inquiries at a rate in excess of 1,000,000 per year.

The attitude of the Department of Agriculture came in for sharp criticism. That department must learn, it was declared, that there is more than mere production. The farmers need the service of the sales specialists of the Department of Commerce.

In the course of the debate, it was declared that the Department of Commerce is rendering a greater service to American business than any other federal department. Its growth was declared to have been wonderful. "It has developed at a rate which would pass anyone's belief, if they were not to investigate it," it was stated by Chairman Winslow of the committee.

French Machinery Fair Proves Popular

The Paris Sample Fair just opened has demonstrated as has no other recent manifestation the strides that the machinery industry has made in the years since the war. That many of the machines suffer by their forced repose as might not be the case in an exposition of more vast proportions is not to be questioned, but their role is important and one has little reason to doubt the claims set forth for those on show.

Sales are made in the machinery section and because of that some indication of the volume of the demand is plain but for the most part, particularly with respect to those of the heavier species, actual orders often result only at a date more or less in the future. Such is the general opinion as expressed by those in charge as proved by former exhibits under like auspices. It is pertinent to state that of the area devoted to machinery that of the Foire de Paris today approaches 20,000 square metres, a growth from 3,000 metres in 1920, 4,000 in 1921, 7,000 in 1922 and 14,000 in 1923. The number of exhibitors increased during the same period from 150 to 550. Co-incident the number of machines in action has consistently increased as well.

Under the impetus given by the Syndicat des Mecaniciens, Chaudronniers et Fondeurs de France, the scope of the machinery exhibited has been enlarged to include all manner of construction and hydraulic machinery as well as steam and gas motive power machinery, woodworking machinery, machine tools in general, transmission and refrigeration machinery, machines for the transformation of textiles, the manufacture of paper, printing machinery and the wide range of electro-mechanics as well as boilers, foundry, sheet, plate and wire making machinery, and other machines.

Monsieur Neuhaus, the president of the Mechanical section of the Foire de Paris, has stated that the destiny of the industry is to live largely by exportation. As against the necessity of France buying a great part of its machinery abroad as in the past, the country now finds itself in a position not only to care for a larger proportion of home needs, but also furnish machinery in world markets hitherto unknown.

Increase in Imports of Iron and Steel

American iron and steel products sent abroad in April amounted to 132,739 gross tons which was a slight improvement over the previous month when 124,762 tons were exported, but represented a decline of 20 per cent from the February figure and of 26 per cent from 179,933 tons, the monthly average for the first three months of the year. The articles making up the bulk of exports were scrap, steel bars, iron and steel plates, boiler tubes and welded pipe, all of which were sold in larger quantities than in the previous month. Ingots, blooms, billets, sheet bars and skelp, plain structural shapes, ferromanganese and spiegeleisen showed noticeable increases, while the products sold in lesser quantities were chiefly hoops, bands and strip steel, tin plate and terneplate, fabricated structural materials and railway materials.

Gage Steel Committee Will Meet

The chairman of the Gage Steel Committee, B. H. Blood, has called a meeting of the committee to be held in Detroit, Mich., on Tuesday. June 17, at 10 p.m. in the General Motors Building. The reports to be given at this meeting will be of special interest and value and all members are urged to attend. It is planned to have a general progress report on the work of the committee, a report on the wear tests, and other reports.

Hudson Tells About Simplification

"With the manufacturer striving to give the buyer what he wants, the while he has to reckon with high wage scales, material prices, transportation costs, and high taxes, and yet facing the knowledge that the buying public is today more exacting than ever before, business leaders of America today face a bewildering complexity of problems," Ray M. Hudson, Assistant Chief of the Division of Simplified Practice, Department of Commerce, told members of the American Boiler Manufacturers Association in convention at Hot Springs, Va., on June 10.

Co-operation with the Division of Simplified Practice, Mr. Hudson said, had resulted in a reduction of waste in several industries. Others are making studies of the excess variety in their products, looking to eliminations which will bring reduced inventories, greater profits and quicker turnover of stocks.

Mr. Hudson cited a recent survey undertaken by the National Association of Sheet and Tin Plate Manufacturers which revealed 27 gages and 150 grades and finishes and hundreds of sizes of sheet steel. He declared that the very size of the variety revealed has set the manufacturers into motion for a simplification.

Five Month Auto Output Breaks Record

The National Automobile Chamber of Commerce estimates the motor vehicle output in May at a total of 301,200 cars. This is nineteen per cent under April and 23 per cent below May, 1923, which had the largest output for any month in the history of the industry.

Production in the first five months was 1,742,832 cars, the largest ever recorded for initial five months of any year. This compared with 1,648,832 cars in the corresponding period of last year.

Stone's Attitude on Associations

Those most concerned as to the trade associations statistical situation are very much encouraged by the attitude of the new Attorney General. Mr. Stone has stated publicly that he is very hopeful of a satisfactory solution of the matter. There is reason to believe that he recognizes that the policy of the Department toward these figures has not been constructive. At the same time the Attorney General is not in a position, it is believed, to discuss his views in detail at this time because of their possible application to pending cases.

It now seems probable that a test case may be brought, although that step will not be taken in the immediate future. In the meantime, consideration is being given the expediting of certain of the pending cases in which certain important trade association questions are involved.

Museum of Engineering Adds Industry to Name

At the meeting held on May 23 the Museum of Engineering, which is being organized to preserve objects of historical interest along engineering lines, made a few changes in the personnel of its directors and an addition to its name. Frederick A. Halsey, as chairman of a special committee on the name of the corporation reported that a preponderance of votes had signified the desire for a change in the name to National Museum of Engineering and Industry, and steps are being taken to effect such a change.

Among the changes in personnel were the election of Dr. E. G. Acheson as vice-president, and Col. J. P. Jackson, Messrs. Bach, Colvin, Luis Jackson, Marburg and Merriam as directors. The resignations of E. W. Rice, Jr., as trustee and of Messrs. Delano, Dunn and Dr. Howe as directors, were accepted with regret. A prospectus of the proposed activities of the Museum has been prepared and will be printed as soon as the necessary funds are available.

Large Increase in French Inventions

The French Bureau for Research and Inventions, during 1923, examined 1,750 propositions for inventions. The commission sits daily and averages at least four propositions at each meeting. The increase in the work of this commission has been notable since its establishment just after the war. In 1920 the number of propositions submitted was but 534, to rise to 806 in 1921 and 1,560 in 1922. These figures demonstrate the spirit of inventiveness current in France today in spite of the fact that the bureau which registers patents is clogged with unexamined propositions which the newly established bureau is somewhat relieving, in that it advises the owner of the project whether or not he should seek to patent, reserving in some cases the right to take the patent for government account if deemed advisable, properly remunerating the inventor, naturally.

Machinery parts of all kinds imported into France in January, 1924, amounted to 1,731 metric tons of a value of 13,943,000 francs as compared with 2,455 tons valued at 20,437,000 francs in 1923 during the same month. Exports were, respectively, 4,458 tons valued at 32,471,000 francs as against 4,651 tons valued at 29,215,000 francs.

Bibliography of Measuring Instruments Ready

The A.S.M.E. has available for loan a few manuscript copies of a Bibliography on Measuring Instruments, prepared particularly from the viewpoint of the mechanical engineer, by F. S. Schlink of the Special Research Committee on Permanency and Accuracy of Indication of Engineering Instruments. This bibliography seeks to cover only those fields not adequately taken care of in other reference sources. The bibliographic entries are about 200 in number. A list of other sources of material especially useful in the field of measurement and measuring instruments is appended.

Milholland Line Acquired by Gisholt Company

The Milholland line of turret lathes and tools has been purchased by the Gisholt Machine Co., Madison, Wis., and will be manufactured by this company in the future. All jigs, fixtures and inventory of finished parts have been shipped from the Milholland Machine Co., Indianapolis, Ind., to the Gisholt company. The buildings and real estate formerly owned by the Milholland company have been purchased by the Stutz Fire Engine Co., Indianapolis.

THE COMFORTERS

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The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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BECAUSE is has become the fashion to blame Washington for the autogenous despression of mind from which business has been suffering some reaction toward cheerfulness manifested itself in the stock market when the tax bill was signed and Congress decided to adjourn on June 7.

With the railway shares in the lead many of the speculative favorites moved upward during the latter part of the week and all the Liberty bond issues touched new high levels after it became known that New York City had sold $67,000,000 of its 4¼ per cent bonds on a 4.20 basis.

It remains to be seen whether the mild and as yet unenthusiastic optimism thus reflected will be lasting, but it is worth noting that even the Federal Reserve Board is more hopeful and that it admits that "there are indications of a break in the business recession that began with the New Year." Bank clearings for May sustain this view for they exceed the same month last year by 2.7 per cent and make it impossible to believe that the recession taken for granted is a fact. The same thing is true of business failures last month for while they number 1816 as compared with 1530 in May 1923 the total liabilities are but $36,590,000 against $41,022,277 a year ago.

But it cannot be said that the flickering hopefulness discernible on the Stock Exchange has as yet spread to commodities. Wheat declined quite sharply when it became apparent that the McNary-Haugen bill would fail. Some recovery followed upon the predicted passage of a compromise measure that would be less objectionable, but as this is written the fate of the compromise is in doubt as is the future of the wheat market. Cotton had a sharp advance when the Government issued a very bullish condition report, but the improvement did not hold because the weather turned better and the longs sold out.

Distributive trade is fairly active but not becoming. Cotton goods continue to be in better demand, but the threatened strike of the garment makers has interfered with the sale of woolen fabrics. The United States consumption of wool in April was 37,600,000 lb. against 48,000,000 lb. last year.

In the iron and steel industry the nadir of the depression seems to have been reached and most authorities are predicting an improvement. The steel mills are said to be running at 60 per cent of their capacity and the pig iron production for May was only 2,615,110 tons as compared with 3,233,428 tons in April, 1924, and 3,867,694 tons in May, 1923, when the production was the largest recorded since the war.

What's Doing in Industry

In some respects the markets took on a steadier tone during the past week, although additional weaknesses were also registered. There were more inquiries for machinery and machine tools received by dealers, and the railroads showed an inclination to complete orders commenced some weeks ago. On the other hand, automobile production again showed signs of weakening, building figures disclosed a noticeable decline, and the stock markets were stagnant.

Railroad stock rallied in Wall Street and freight car loading increased slightly over figures for the past two weeks.

The adjournment of Congress was generally welcomed by industrialists, who feel that but little has been done for business during the past session and that inactivity is preferable.

It is generally conceded that June will prove to be another dull month with a slight improvement noted over April and May business.

Exporting has not improved, although the first half of the year will show excellent totals. The last half of 1924 is not expected to be as good.

As the post war minimum was 864,553 tons in July, 1921, it is apparent that the decrease in May of this year is not as startling as a superficial comparison of the figures would indicate. Lead, zinc and tin are a little higher, but copper seems to be permanently stabilized at about 12¾ cents.

The lumber output showed a slight decrease in May, but prices are unchanged. The production of crude petroleum is gaining and lower prices for both oil and gasoline are predicted.

Automobile production in May was 19 per cent under April, but for the five months of 1924 the total output was 1,742,832 cars of all sorts. This is an increase of 94,000 over last year. Rubber advanced about a cent a pound on Wednesday upon the execution of some small buying orders. The sentiment is bearish, but stocks are small and the position is inherently bullish.

Car loadings are picking up. The traffic on the Missouri Pacific in May broke all records and several other important systems are running ahead of last year's figures. Earnings of the Class 1 roads in April were equal to 4.57 per cent on the current valuation of $19,745,000,000. This compares with 6.51 per cent last year. A great Chicago terminal for the New York Central, Baltimore & Ohio and Rock Island is being planned. It will cost $100,000,000. It has been made possible by the decline in interest rates which has carried call money to 2½ per cent and made money in New York cheaper than in London.

The Federal Reserve statement shows a reserve ratio of 82.2 per cent and total assets of $4,788,523,000, of which only $856,243,000 are earning anything. It seems doubtful whether the Federal Reserve Banks will make enough to pay their expenses this year unless they reduce rates still further and it is probable that the ease with which money can be borrowed will overcome the timidity induced by the mistaken fervor with which caution has been preached by some highly placed authorities.

But we must be prepared for a partial suspension of activity while the two political conventions are in session. After they have adjourned business as usual is to be expected until the campaign commences, when people will again turn their attention to politics and elect a president under whom the country will be safe, no matter whether he be a Republican or a Democrat.

Of any serious trouble abroad there seems to be but little probability.

Sugar is at the low point of the present movement and Cuban raws for delivery at New York in March, 1925 can now be bought at less than 3 cents a pound "cost and freight, ex duty." As this price is within about one cent of the low record for all time I unhesitatingly recommend those who deal in sugar to cover their prospective requirements for the next twelve months by the purchase of March contracts.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Philadelphia

While uncertainty continued in the industrial situation in Philadelphia this week, machinery manufacturers and dealers do not look at the future through gloomy eyes. Many of the manufacturers report an encouraging number of inquiries from well distributed sources. Among the larger producers it was said the business amounted to about 60 per cent of what normal conditions would bring at this time of the year.

Machine tool makers have received word that some of the Eastern railroads are soon to be in the field for replacements. Inasmuch as the roads have not been extensive buyers for some time the belief prevails that soon there will be a substantial flow from this source. The period to be covered within the next thirty days is expected by manufacturers, jobbers and dealers to bring a greater volume of business, or at least to indicate how the remainder of the year will be.

Manufacturers and dealers in farm implements say they have had a better business this season than they had in the corresponding period of last year. Notwithstanding this the trade is considerably dulier than it is in normal periods.

Cincinnati

The machine tool market in Cincinnati has changed but little in the past two weeks. Conditions are spotty with some plants reporting a fair number of orders and others stating that buyers are holding off and are placing but little business. Inquiries are being received in fair volume, but extreme difficulty is being experienced in closing orders due to the caution displayed by industrial purchasers. There has been some buying by automobile manufacturers, but it has been in restricted quantities and confined to replacements. The railroads have shown a tendency to make purchases and in certain instances have placed good business, but here again conservatism rules and machine tool houses report that the railroads are not buying as freely as had been anticipated.

The production of both lathes and milling machines has slowed down, while the demand for drilling machinery is rather spotty. Planers are in fair demand while conveying machinery houses are operating on a satisfactory schedule. Electrical tool manufacturers have been experiencing a good business during the spring season, but production has fallen off somewhat in the past few weeks. Woodworking machinery firms still are enjoying a comfortable volume of business and they have a fair number of orders booked ahead. The used machinery market has been good during the last few weeks and there has been considerable activity manifested. The Cincinnati machine tool market, taken as a whole, is operating at about forty to forty-five per cent of its normal capacity.

Local foundries have been running on a curtailed basis while the steel casting business has been fairly active. The unemployment situation showed some improvement during May, although there is still a noticeable surplus of skilled labor among shop and railroad machinists.

Cleveland

This week has brought a new change into the machinery and machine tool field in the Cleveland district. During the first week of June there has been a significant improvement in the number of inquiries for all types of heavy equipment, and a fair change for the better regarding the lighter types. But the machine tool factors themsleves have been fooled more than once by these periodical monthly changes for the better, and consequently are not over enthusiastic at this time

The reason for this is that these inquiries are not backed by actual orders. In practically every instance, leading men in the trade report, these inquiries are qualified that some time in the early future the prospective buying plants will be in the market to replace their present equipment with newer and more modern tools.

Perhaps the best indications for betterment in actual demand may be seen in the automatic field and also among the planer element.

Buffalo

Buffalo's diversified industry seems to be keeping the machinery dealers of this city from feeling as acute a falling off in business as is reported from some other centers. Dealers who go after business—and most of them are doing just that at this time—report a volume of business on small orders taken here and there that is satisfactory, considering all conditions and the season of the year. The general impression seems to be that as soon as the weather becomes settled, so that the buying of automobiles and other commodities that have been held back by adverse weather picks up, there will be a general upward movement in the machinery market.

One large order noted is the purchase last week by the Union Pacific railroad from a Buffalo manufacturer of a large punch, shear and bar cutter and one large special bar cutter. The same firm reports the sale of a large punch and shearing machine to a Southern industrial plant. However, very few stock orders are being placed by wholesalers with Buffalo machinery makers; and those in the business believe that, in spite of this fact, many jobbers have very little stock on their floors.

It is reported that at least one of the large lots of used machine tools from dismantled plants which are being sold in this section is still about 80 per cent unsold and it is the belief of local dealers that the balance of this equipment will be sold by public auction in the near future, which would probably mean that much of this used equipment would pass into the hands of local dealers for later resale.

Some inquiries which were put out as long ago as six months are just now being closed, but there are few new lists out. Many of those which are being closed have been cut about 50 per cent from their original size.

Detroit

With the advent of warmer weather leaders in the machine tool and machinery field anticipate a keener competition among firms for the business which annually accompanies the changes in models which most automobile manufacturers make at this time of the year.

At the same time they point to May as being a much better month in Detroit and vicinity than April was, and there is every prospect that June will equal May when the total record of sales is listed. Much equipment will be purchased during the coming two months.

Most Detroit factories are preparing for the introduction of new models. The new models will make their appearance beginning in three or four weeks. Practically all new models will have four-wheel brakes as standard equipment and nearly all will have balloon tires as standard or optional equipment.

Inquiries just at this time are limited somewhat in number, but machinery men say that the proportion of inquiries resulting in actual sales is much higher now than for some time past.

New York

Some buying on the part of the railroads in the New York market and an increase in the number of inquiries were the only encouraging signs in the New York machinery and machine tool market this week. Southern roads are still buying, while lists from the Eastern railroads were received by the dealers. Rumors of purchasing by the D. & H. railroad in the near future were heard in the district and purchases by the New York Central, Norfolk &

Western and some New England roads were received.

Automobile makers in the East have given no orders of size in the past month and dealers feel that something will be forthcoming from this source before long.

The big electric companies have been good buyers for the past two months which has been a distinct help. General industrials are buying only necessities.

The used tool market has been active for the past six weeks and the record for the first six months of the year will be far ahead of that of the same period last year.

Exporting continues in good volume, although exporters do not expect business to keep up during the next few months as it has in the past.

Car Loading Shows Slight Increase

Loading of revenue freight for the week which ended on May 24 totaled 918,213 cars, according to reports filed by the carriers with the Car Service Division of the American Railway Association.

This was an increase of 4,806 cars compared with the preceding week, but a decrease of 97,319 cars under the corresponding week last year. Compared with the corresponding week in 1922, when freight shipments were somewhat reduced due to the miners' strike then in effect, it was an increase of 111,336 cars.

Coal loading totaled 139,083 cars, 3,433 cars above the preceding week, but 53,313 cars under the corresponding week one year ago. Due to the miners' strike, it was an increase of 48,353 cars over the same week in 1922.

Ore loading totaled 55,405 cars. This was an increase of 22 cars over the preceding week but a decrease of 14,728 cars under the same week last year.

Last Year's Output of Steel Itemized

Production in 1923, in gross tons of 2,240 pounds, as now officially reported was: Steel ingots, 43,485,665 tons; steel castings, 1,458,031; rolled iron, 955,597; rolled steel, 32,321,479; total rolled, 33,277,076. In this production were included 2,094,516 tons of rails, 3,075,892 of plates, 3,830,142 of sheets and black plate specialties and 5,552,796 of merchant bars. Among products made from the rolled material were 3,351,023 tons of welded tubular goods, 1,506,861 of tin and terne plate and 1,055,742 of galvanized sheets, 829,604 kegs of cut nails and 17,672,582 of wire nails.

Production in 1923 and in 1917 was substantially the same, the two years being the two largest in the history of the steel trade. In steel ingots, production was one-third of 1 per cent less than in 1917, steel castings ran 1 per cent greater, rolled steel 3½ per cent greater, rolled iron only a trifle over half as much and rolled iron and steel together gained slightly less than 1 per cent.

The fact of practical interest is that production ran approximately one-third greater in 1923 than the average of the four post-war years and one-third greater than in 1912 and 1913, the two best tonnage years before the war.

Business Items

The New York office of R. S. Stokvis & Zonen has been moved from 2843 Whitehall Building to 1521 Whitehall Building.

The Los Angeles, Calif., branch of the Chicago Pneumatic Tool Co., New York, has been moved to 655 Santa Fe Ave. from 307 East Third St.

J. H. Williams & Co. announce that they have completed moving their Brooklyn and Chicago factories to Buffalo. District offices will be maintained at 75-77 Spring St., New York City, and 117 N. Jefferson St., Chicago.

In spite of rumors to the contrary, it is learned that there has been no change in the plans of the Patterson Tool & Supply Co., Dayton, Ohio, which will continue its machinery and supply departments to the same extent as in the past.

The Triple Action Spring Co., New York, has moved to 246 W. 61st St.

It is expected that the negotiations for the purchase of the Hurley Machine Co. by the General Electric Co. will be completed by July 5.

The Loshbough-Jordan Tool & Machine Co. has been incorporated at Elkhart, Ind., with a capital stock of $100,000 to manufacture tools, dies and machinery. The incorporators are J. E. Loshbough, M. R. Loshbough, J. E. Jordan and M. M. Jordan, all of Elkhart.

The land, buildings, equipment, and machinery of the Barney & Smith Car Co., Dayton, Ohio, will be sold at auction on Thursday, June 12. Several previous attempts to dispose of the property at auction have failed to bring the minimum price required by law.

Obituaries

EDWARD F. HUBBARD, aged 60 years, died recently in Bristol, Conn. He was assistant foreman of the bearing machine department of the New Departure Manufacturing Co., Bristol.

JAMES T. FAHNESTOCK, treasurer of the Pennsylvania railroad since 1909, also treasurer of the Long Island railroad, died in a New York hospital June 8 following an operation for appendicitis, performed on May 30. He was 64 years old.

ALBERT THORNE, cashier for the General Electric Co., Schenectady, N. Y., was killed in an automobile accident in Cincinnati on May 30.

Personals

RONALD WILSON has returned to the Brown & Sharpe Manufacturing Co., Providence, R. I., as mechanical engineer of gear cutters. Mr. Wilson was formerly a tool designer with the Cadillac Motor Car Co., Detroit, Mich.

WILLIAM C. SIMS, formerly tool engineer with the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, has accepted a position as works manager with the Hall Safe Co., Cincinnati.

L. S. CARROLL, formerly general purchasing agent of the American Locomotive Co., New York City, has been elected vice-president in charge of purchases of that company.

N. C. HURLEY, president of the Hurley Machine Co., Cicero, Ill., will sail for Europe July 5.

WILLIAM H. WOODIN, president of the American Car & Foundry Co., has resigned as a director of the Westinghouse Electric & Manufacturing Co. and the American Beet Sugar Co. According to reports in financial circles, his resignation as a director in the following corporations is expected: the American Locomotive Co., the Canadian Car & Foundry Co., the Chase Securities Corp., the Cuba Railroad Co., the General Motors Co., Montreal Locomotive Works, Vacherie Cypress Co., and the American Exchange Securities Co.

CLARENCE A. EARL, formerly president of Earl Motors and National Motors has accepted the presidency of the Serrell Electric Appliance Co., New York.

A. A. BULL, chief engineer of the Northway Motors & Manufacturing Co., has sailed for Europe.

SAM V. HARDING, formerly with the Nordyke & Marmon Co., has been appointed service manager of the Columbia Motors Co.

C. C. MINER has resigned as president and general manager of the Inland Products Co., St. Louis.

M. M. MCINTYRE has left the Perfection Spring Co. and has become general superintendent of the Philadelphia Spring Co., Philadelphia, Pa.

HARRY KLINE has been made advertising and publicity manager of the Continental Motors Co., Detroit.

JOSEPH E. FIELDS has been named vice-president in charge of sales of the Maxwell-Chrysler companies.

M. D. CHURCH has become the general manager of the Moore Steam Turbine Corp., Wellsville, N. Y.

ARTHUR H. HALL has been made sales manager of the Hendey Machine Co., Torrington, Conn. He has been with the company for the past twenty-eight years.

A. G. HOPCRAFT, purchasing agent of the Ferro Machine & Foundry Co., Cleveland, Ohio, has been elected president of the National Association of Purchasing Agents. Mr. Hopcraft was formerly president of the Cleveland Association of Purchasing Agents.

E. B. MERRIAM, executive engineer of the switchboard department of the General Electric Co. at Schenectady, has been elected a member of the board of managers of the American Institute of Electrical Engineers. This is the national governing body of the Institute.

CARL J. SHERER has been named assistant to the president of the Nordyke & Marmon Co., Indianapolis, Ind. Mr. Sherer was formerly secretary-treasurer of the Dayton-Wright Co., Dayton, Ohio.

HERMAN LEMP, engineer in charge of the internal combustion engine engineering department of the General Electric Co. at Erie, has resigned his connection with that concern to join the Erie Steam Shovel Co. This follows an association with the General Electric Co. for 42 years.

FRED M. ZEDER has been elected vice-president of the Maxwell-Chrysler Corp. in charge of engineering. He was formerly chief engineer.

P. L. CHASE, formerly with the Republic Motor Truck Co. of Alma, Mich., has been appointed manager of the factory branch which has been opened by the Mason Motor Truck Co. of Flint in St. Louis, Mo.

WALTER P. HANSON has been appointed advertising manager of the Republic Motor Truck Co. of Alma, Mich.

Railroads Show Decrease in April

Class 1 railroads of the United States have reported a total net operating income of $61,821,900 for April, compared with $83,515,300 in April of last year. Figured on the tentative valuation the earnings for April were equivalent to 4.72 per cent compared with 6.50 per cent in April, 1923, when the percentage earnings were higher than for any month since the government operation period.

Figures compiled by the Bureau of Railway Economics indicate that the decline in gross revenue was largely responsible for the poor showing in comparison with April of last year. For April the gross income was $474,821,580, or $48,482,000 less than for the same month of last year. To offset this loss the railroads made a cut of $26,455,700, or 6.5 per cent in operating expenses, which totaled $377,692,300 for the month.

In March, 1924, the net operating income was $80,239,844, and the gross $505,124,921. There was an increase in the number of railroads that operated at a loss during April, as compared with the previous month. The records show that 41 carriers reported an operating loss for the month, 19 of them being in the Eastern District and 22 in the Western District. In March, 34 railroads reported an operating deficit.

For the first four months this year the Class 1 railroads had a net operating income of $264,732,400, compared with $268,212,000 for the same period of last year.

Chicago Machinery Club Elects Officers

At the annual meeting of the Machinery Club of Chicago the following officers were elected for the coming year: H. S. White, president; F. L. Kohlhase, vice-president; H. J. Reeve, treasurer; R. W. Barry, secretary; and H. F. Kempe, assistant secretary. The following were elected committee chairmen; House Committee, H. F. Kempe; Entertainment Committee, R. W. Barry; Indoor Sports Committee, C. H. James, Picnic Committee, George Habicht, Jr., Inter-Club Relations Committee, Oscar Wodack; Magazine Committee, D. R. Hoffman; Membership Committee, W. A. Slack; Finance Committee, H. J. Reeve; Outdoor Sports Committee, J. R. Porter; Publicity Committee, Win Conley; Hostesses, Mrs. H. S. White.

Highway Appropriation Is Cut Down

As a result of the reduction in taxation and the passage of the soldiers' bonus and other measures calling for large appropriations, the bill authorizing appropriations for the continuance of Federal aid for highway construction has been reduced from the proposed expenditure of $100,000,000 annually for three years to $75,000,000 annually for two years. Legislation in this form has been approved by the House committee and now awaits action by Congress. This means some reduction in the road-building program in the following sixteen states: Illinois, New Jersey, Delaware, Indiana, Ohio, Alabama, Florida, Kentucky, Nevada, Oklahoma, West Virgina, Arizona, Louisiana, South Dakota, Mississippi, and Virgina.

Another point which had weight with the Committee is the objection which has been raised to one Congress attempting to commit another. A three-year program would have projected itself into a new Congress.

Revised Figures on April Auto Output

A revision of the estimate of motor car production in the United States in April has been made by the National Automobile Chamber of Commerce. The output last month was 358,600 cars against 337,000 given in the first estimate. Production figures in March approximated 382,459 cars. The total output for the first four months of 1924 aggregated 1,424,720 cars and trucks against 1,258,198 in the same period last year.

Trade Catalogs

Machine Shop Tools. W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa. Drill and reamer holders, arbor presses and lathe mandrels are described and the prices quoted in this catalog.

Machine Tools. The J. G. Blount Co., Everett, Mass. Catalog No. 21 shows the full line of this company; each tool being illustrated and well described. There are sixty-seven pages.

Motors. The Wagner Electric Corp., St. Louis, Mo. Three pamphlets have been issued by this corporation describing the merits of the Flynn-Weichsel motors. Some recent tests and observations are recorded and the booklets contain much that is of interest to power users.

Fittings for Pipe Structures. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The various pipe fittings made by this company are shown and described with full dimensions in this catalog that has recently been issued.

Pyrometers. The Brown Instrument Co., Philadelphia, Pa. "Instructions for Installation and Care of Thermo-Electric Pyrometers" is the title of this booklet in which the product of the firm is not only lucidly described, but the methods of getting the most out of the instrument is shown by the carefully prepared text. This book is a real service to users of pyrometers and should set a good example to other manufacturers.

Machine Tools. Joseph T. Ryerson & Son, Inc., Chicago, Ill. A series of loose leaves show the magnitude of this concern and the many industries that it serves. The iron and steel that is carried in stock by the company and the many feet of floor space used is impressed upon the observer of these pictures.

Pamphlets Received

Elimination of Waste. United States Department of Commerce. Government Printing Office, Washington, D. C. The pamphlet is devoted to the elimination of waste in the manufacture of files and rasps. It comes under the head of simplified practice recommendation.

Sources of Cost Information. Metropolitan Life Insurance Co., New York City. This is No. 6 of the Business Leaflet series.

Metallography of Sand Cast Aluminum Alloys. Air Service Information Circular. Government Printing Office, Washington, D. C. This circular has been prepared by A. J. Lyons and Samuel Daniels of the Engineering Division of the Air Service, McCook Field, Dayton, Ohio. The subject is comprehensively treated and there are interesting illustrations included.

Forthcoming Meetings

Gas Products Association. Tenth annual meeting. June 10, 11 and 12. Ambassador Hotel, Atlantic City, N. J. C. T. Price, secretary and treasurer, 140 S. Dearborn St., Chicago, Ill.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

American Society for Testing Materials. Twenty-seventh annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Week of June 23. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

Society of Automotive Engineers. Summer Meeting. June 24, 25, 26 and 27. Spring Lake, N. J. C. F. Clarkson, secretary, 29 W. 39th St., New York City.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Foundrymen's Association. Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

Management Week. Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Heavy drop in May iron output. No. 2 foundry grade, $22 per ton Birmingham, against range of $22@$23 one week ago. Pig-iron buying confined to small tonnage lots. May steel ingot production was 21 per cent below the month preceding. Improvement in demand for steel plates, however, reported during week; present price, $2@$2.25 per 100 lb., Pittsburgh. Steel bars quoted at $2.20@$2.25 and shapes at $2.10@$2.25 per 100 lb. at mill. The current range of steel prices is a trifle below the level of May 29.

Non-Ferrous Metals—Market for all non-ferrous metals improved in tone. Copper demand better; no price change from level of May 29. Higher tin and zinc prices reflect advances abroad. Tin advanced 3c.; lead, ¼c. and zinc, ¼c. per lb. since May 29 in New York warehouses.

(All prices as of June 6)

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	$2.80@3.00	4.14	3.65	4.00
No. 12	2.90@3.10	4.19	3.70	4.05
No. 14	3.00@3.20	4.24	3.75	4.10
No. 16	3.20@3.40	4.34	3.85	4.20
Black				
Nos. 17 and 21	3.50@3.70	4.65	4.35	4.55
Nos. 22 and 24	3.55@3.75	4.70	4.40	4.55
Nos. 25 and 26	3.60@3.80	4.75	4.45	4.60
No. 28	3.65@3.85	4.85	4.55	4.70
Galvanized				
Nos. 10 and 11	3.80@4.00	4.90	....	4.60
Nos. 12 and 14	3.90@5.10	5.00	....	4.70
Nos. 17 and 21	4.20@4.40	5.30	....	5.00
Nos. 22 and 24	4.35@4.55	5.45	5.10	5.15
No. 26	4.50@4.70	5.55	5.35	5.30
No. 28	4.80@5.00	5.85	5.65	5.60

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	4.59	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.40
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	4.10	4.00
Cold drawn flats, squares	4.90	4.60	4.50
Structural shapes (base)	3.59	3.46	3.30
Soft steel bars (base)	3.49	3.36	3.20
Soft steel bar shapes (base)	3.49	3.36	3.20
Soft steel bands (base)	4.09	3.61	3.95
Tank plates (base)	3.59	3.46	3.30
Bar iron (3.00 at mill)	3.49	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	60%	40@55%	50%

Electric welding wire, New York, 5/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.25
Tin, 5-ton lots, New York			43.00
Lead (up to carlots), St. Louis	6.85	New York	7.62½
Zinc (up to carlots), St. Louis	5.90	New York	6.75

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.00	30.00	28.50
Antimony (Chinese), ton spot	9.00	10.50	10.00
Copper sheets, base	20.25	20.25@20.50	23.00
Copper wire, base	15.50	18.25	16.25
Copper bars, base	19.25	21.50	19.50
Copper tubing, base	22.25	26.50	23.00
Brass sheets, base	16.75	21.00	18.75
Brass tubing, base	21.00	26.00	20.50
Brass rods, base	14.50	17.00	15.75
Brass wire, base	17.25	21.00	.....
Zinc sheets (casks)	10.50	10.75	.....
Solder (½ and ½), (case lots)	33.50	30.00	30.00
Babbitt metal (83% tin)	60.00	53.00	48@52
Babbitt metal (35% tin)	28.00	17.50	23@26
Nickel (ingot and shot) f.o.b. refinery	27.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	30.00	.....	35.00
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54.00
Manganese nickel hot rolled rods "D"—high manganese (base) 57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00@10.75	10.00	10.75
Copper, heavy, and wire	9.62½@10.50	9.50	10.00
Copper, light, and bottoms	8.50@9.00	8.50	9.00
Lead, heavy	5.62½@6.00	5.00	6.50
Lead, tea	4.37½@5.00	3.00	5.50
Brass, heavy, yellow	6.50	....	6.50
Brass, heavy, red	8.50 @8.75	8.75	8.50
Brass, light	5.75	4.50	6.00
No. 1 yellow brass turnings	6.50 @6.75	5.50	6.50
Zinc	3.50 @3.75	3.50	3.50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$24.30	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	20.20	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.12½	.17	.10½
Wiping cloths, 13½x13½, per lb	10.75†	36.00 per M	.16
Wiping cloths, 13½x20½, per lb.	....	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.98	1.07	.94
Lard cutting oil, 25% lard, per gal.	.55	.50	.79*
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber transmission:			
First grade	50%	50–10%	40–10%
Second grade	50–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag	....	.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.25@3.50
Coke, prompt foundry, Connellsville	per net ton		4.50@5.00
White lead, dry or in oil	100 lb. kegs	New York, 15.00	
Red lead, dry	100 lb. kegs	New York, 15.00	
Red lead, in oil	100 lb. kegs	New York, 16.50	

*Chicago quotes on pure lard oil, No. 1 grade.
†White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0349	$0.0349	$0.0354
Cold finished shafting	per lb.	0.044	0.044	0.044
Brass rods	per lb	0.145	0.15	0.1875
Solder (½ and ½)	per lb.	0.335	0.37	31.50@33.50
Cotton waste	per lb.	.14@.21	.14@.21	.10@.13
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	0.55	0.55	0.65
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	50%	45%	30%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	60–10–5%	55–5%
1½ and 1½x3 in. up to 12 in	15%	60%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	35%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	3.50
Hex. head and hex. nut bolts	List net	.....	List plus 10%
Lag screws, coach screws	50%	.....	50–5%
Square and hex. head cap screws	75%	75%	75–5%
Carriage bolts, up to 1 in.x30 in.	40%	60%	50–5%
Bolt ends, with hot pressed nuts	50%	.....	55–5%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 5/16 and smaller	70%	.....	.....
Semi-finished nuts, ⅜ and larger	65%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, ⅜ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.50	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	4.00	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	4.00	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.50	4.00	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.50	4.00	3.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50%	60–10%	60%
Rivets, tinned	50%	60–10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.50	$3.75
Cone heads, ditto (net)	5.20	3.60	3.95
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	$4.20 base

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., Norwalk—A. Seymour, 142 Main St.—grinder, buffer and portable drill with bench stand, all electrically operated.

D. C., Wash.—Southern R.R., Southern Bldg., C. R. Craig, Genl. Purch. Agt.—one 2,500 lb. single frame steam hammer and one 24 in. heavy duty lathe.

Md., Baltimore—C. A. Thumm, 125 Light St.—one small motor driven reaming machine, to ream holes up to and including 1¼ in.

Mass., Boston—City, School House Dept., T. Glynn, Chn., City Hall—manual training equipment for proposed $1,300,000 school.

Mass., Pittsfield—General Electric Co., 100 Woodlawn Ave., C. C. Chesney, Mgr.—machine shop equipment.

Mo., St. Louis — Bd. Educ., 911 Locust St., R. M. Milligan, Comr. Bldgs.—receiving bids until June 20 for wood turning, joining, forge, machine and auto shop equipment, including lathes, for manual training department of high school.

N. Y., Adams Center—Yellow Tree Inn Garage, Church St., W. H. Alexander, Purch. Agt.—18 to 20 in. vertical post drill.

N. Y., Buffalo — Bd. Educ., 1400 Telephone Bldg.—receiving bids until June 18 for manual training machinery, including grinders, turning lathes, saws, jointer, etc.

N. Y., Niagara Falls — Lauer & Mack Co., 1400 College Ave.—machinery, tools, etc., for proposed planing mill, to replace fire loss.

N. Y., Ogdensburg—W. Smith Co., Jersey Ave.—bench miller and tool room lathe for garage and machine shop.

N. Y., Sacket Harbor—Hazlewood Co., Bedford Gardens, L. Hazlewood, Purch. Agt.—motor driven bench planer for repair shop.

N. Y., Syracuse — Syracuse Vulcanizing Co., Inc., H. V. Jones, 1803 Bellevue Ave., Purch. Agt.—lathe for mounting rubber excoriating brushes.

N. Y., Watervliet—J. S. Tilley Ladder Co., 2nd St.,—lathes, multiple drills, saws, planers and one moulder with direct connected motor driven feed, heads, etc., to feed at least 110 ft. per minute.

N. C., Statesville—J. C. Steele & Sons (manufacturer of brick making and clay working machinery), C. M. Steele, Purch. Agt.—tool and cutter grinder, plain or Universal, small size (used).

Pa., Blawnox — The Blaw Knox Co. (steel)—5 ton trolley.

Pa., Carrick (Pittsburgh P. O.)—Bd. Educ.—six large woodworking machines, etc.

Pa., Conshohocken—John Wood Mfg. Co.—gap press, capacity 6 x 6 in. hole in 18 gage sheet.

Pa., Pittsburgh—Bd. Educ., 701 Fulton Bldg.—receiving bids until June 16 for manual training equipment for junior and senior high school.

Pa., Pittsburgh — Mackintosh Hemphill Co., 12th St.—grinding machines and electrical tools for foundry.

Tex., Dallas—W. A. Browning Mchy. Co., 3125 Elm St.—machine shop equipment.

W. Va., Nitro—Builders Supply Co.—ripsaw, planer and other woodworking machinery.

Wis., Milwaukee—H. H. Graboske, 1627 St. Paul Ave. (manufacturer of store fixtures)—woodworking machinery, sticker, sander, etc.

Wis., Milwaukee—O. H. Kindt, 986 47th St. (woodworking)—3 or 4 in. sticker and planer.

Wis., Milwaukee—E. K. Swigart, 398 38th St.—large boring mill, medium size planer, drill presses and lathe, all with individual motors.

Wis., Milwaukee—Valley Coal & Dock Co., 373 Bway.—belt conveyor coal unloading equipment, capacity 250 ton per hour, for Kincardine, Ont.

Wis., Milwaukee—H. G. Wild, 653 Clinton St. (manufacturer of automobile accessories)—one ton electric crane.

Ont., Blyth—Flood, Taylor & Laundy—woodworking equipment, planers, saws, lathe, etc., for planing mill, to replace fire loss.

Ont., Kingston—F. A. Breeze—complete machine shop equipment.

Ont., London—Richards Wilcox Canadian Co., Chelsea Green, W. R. Yendall, Mgr.—Metal working machinery and tools for the manufacture of hardware specialties.

Ont., South Indian — L. Bellefeuille — complete equipment for blacksmith shop.

Que., Lachine—J. A. Dragon, 221 St. Joseph St.—moulder, sticker, etc., for sash and door factory.

Que., Montreal — Canadian Natl. R.R., 230 St. James St., R. C. Vaughn, Dir. of Purchases—coaling plant, 250 ton capacity, at Stratford, Ont.

Que., Montreal—Canadian Pacific Ry., Windsor Sta., E. N. Bender, Genl. Purch. Agt.—about $302,020 worth of machinery.

Que., Montreal—J. Galipeau, 506 Moreau St.—machinery for pattern shop.

Que., Montreal — Industrial Garage & Machine Shop, Reg., 914 Notre Dame St., West, A. Larocque, Purch. Agt.—equipment for automobile repair shop.

Que., Montreal—W. E. Painter, 4 Buckingham Ave.—equipment for cabinet shop.

Que., Montreal—H. Papas, 127 Metcalfe St.—equipment for automobile repair shop.

Que., Montreal—A. Tremblay, 900 St. Denis St.—repair equipment for garage.

Opportunities for Future Business

Calif., Oakland — The Illinois Wire & Cable Co., Sycamore, Ill., awarded the contract for the construction of first unit of factory, to include six buildings, on 80th Ave., here. Estimated cost $40,600. Noted Apr. 17.

Calif., Oakland—The Union Constr. Co., Key Route Fill (shipbuilding), plans to rebuild its plant, including pattern, machine shops, etc., which was recently destroyed by fire. Estimated cost $350,000.

Calif., San Francisco — The Gulfoy Cornice Wks., 209 8th St., awarded the contract for the construction of a 1 story shop on Howard St. Estimated cost $15,000.

Calif., San Francisco—The Payne Bolt Wks., Howard and Main Sts., awarded the contract for the construction of a 1 story addition to shop. Cost will exceed $20,000.

Colo., Denver—The Westinghouse Electric & Mfg. Co., Union Bank Bldg., Pittsburgh, Pa., plans to build a warehouse, service and repair shops, here. Estimated cost $500,000.

Ga., Atlanta—A. C. Miller & Co., manufacturers of automobile truck bodies, are having plans prepared for the construction of a 3 story, 75 x 180 ft. plant, including forge and woodworking shops. Lockwood, Greene & Co., Healey Bldg., Engrs.

Ind., Batesville — The Union Furniture Co. is having plans prepared for the construction of a 4 story, 18 x 72 ft. factory. Estimated cost $50,000. M. Fisher, Brighton Bank Bldg., Cincinnati, Engr.

Mich., Iron Mountain—The Ford Motor Co., Highland Park (Detroit P. O.), is receiving bids for the construction of a 1 story, 79 x 260 ft. sawmill, here. A. Kahn, Marquette Bldg., Detroit, Archt.

Mo., St. Louis—The St. Louis Police Dept., 112 South 12th Blvd., awarded the contract for the construction of a 2 story, 154 x 154 ft. garage and auto service shop. Estimated cost $150,000. Noted Apr. 17.

N. Y., New York—The Five Hundred Seven West 166th St., Inc., 131 East 91st St., awarded the contract for the construction of a 5 story garage at 503 West 166th St. Estimated cost $175,000. W. F. Cunningham, Pres.

N. Y., Niagara Falls—The Lauer & Mack Co., 1400 College Ave., plans to rebuild its planing mill on Highland Ave., which was recently destroyed by fire. Estimated cost $35,000.

N. Y., Watervliet—The J. S. Tilley Ladder Co. is building a 4 story, 68 x 90 ft. addition to its woodworking factory on 2nd St. Estimated cost $160,000.

O., Cleveland — The Industrial Machine Co., c/o H. L. Vreeman, Pres., 2160 Superior Ave., awarded the contract for the construction of a 1 story, 50 x 100 ft. factory on East 47th St. Estimated cost $40,000.

Pa., Connellsville—The Western Maryland Ry. Co., Standard Oil Bldg., St. Paul and Franklin Sts., Baltimore, Md., plans to rebuild its locomotive repair shops and engine house at Bower, near here, which were recently destroyed by fire. H. R. Pratt, ch. engr.

Pa., Franklin—The Franklin Valveless Engine Co. plans to rebuild its plant, which was recently destroyed by fire. Estimated cost $150,000.

Pa., Meadville—The Hookless Fastener Co. awarded the contract for the construction of a 5 story, 70 x 70 ft. factory. Estimated cost $60,000.

Pa., Phila.—The Berroden Auto Supply Co., 713 North Broad St., will soon award the contract for the construction of a 3 story, 57 x 130 ft. factory on Broad and Olive Sts. Estimated cost $150,000. P. Tyre, 1509 Arch St., Archt.

Pa., Phila.—The Heintz Mfg. Co., Front and Olney Sts., awarded the contract for the construction of a 1 story, 50 x 70 ft. addition to factory for the manufacture of pressed steel automobile bodies.

Pa., Phila.—The O'Brien Mchy. Co., 113 North 3rd St., will build a 1 story, 61 x 155 ft. addition to its plant. Estimated cost $55,000.

Pa., Upper Darby—The Kinetic Eng. Co., 60th and Baltimore Sts., Phila., awarded the contract for the construction of a 1 and 2 story, 60 x 140 ft. factory for the manufacture of blowers, on Union Ave., here. Estimated cost $30,000. Noted May 15.

Tex., Dallas—The W. A. Browning Mchy. Co., 3125 Elm St., awarded the contract for the construction of a 50 x 100 x 300 ft. machine shop on Commerce St. Cost will exceed $40,000.

Wis., Neillsville—Clark Co., O. J. Weyhmiller, Hy. Comr., will soon award the contract for the construction of a 1 story, 50 x 100 ft. machine shop. Estimated cost $40,000. Private plans.

Ont., Blyth—Flood, Taylor & Laundy plan to rebuild planing mill which was destroyed by fire. Estimated cost $15,000.

Ont., Deseronto—The E. B. Eddy Co., Ltd., Bridge St., Hull, Que. plans to build a match factory, here. Estimated cost $250,000.

Ont., London—The Richards Wilcox Canadian Co., Chelsea Green, is receiving bids for the construction of a 150 x 250 ft. factory for the manufacture of hardware specialties. Estimated cost $50,000. W. R. Yendall, Mgr.

Ont., Sarnia — The Doherty Stove Co. plans to build a 150 x 400 ft. factory for the manufacture of furnaces, hot water heating equipment and electric stoves. Estimated cost $150,000.